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The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

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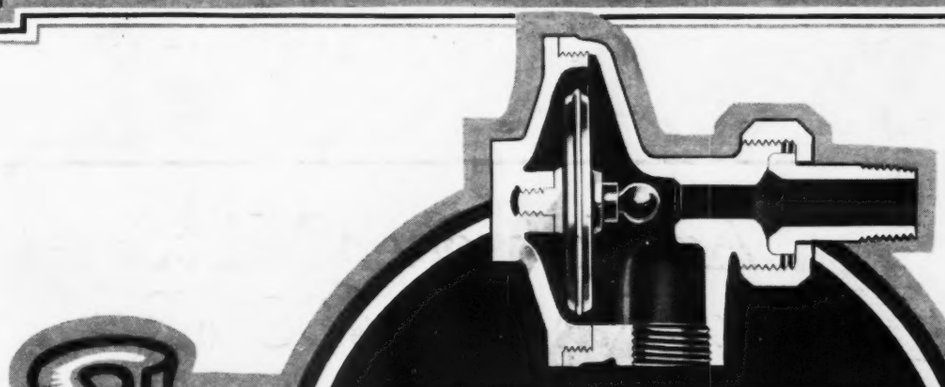

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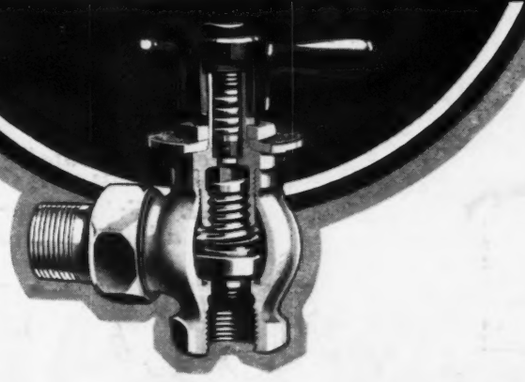

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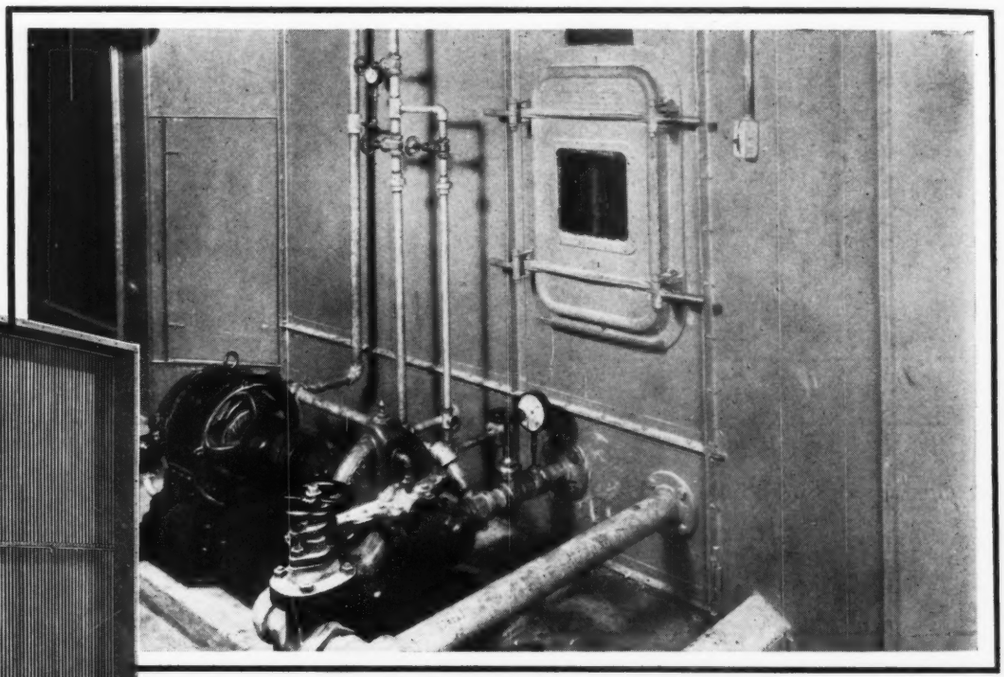

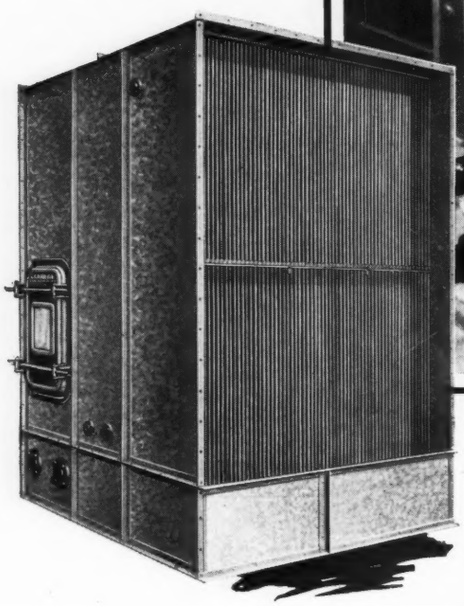

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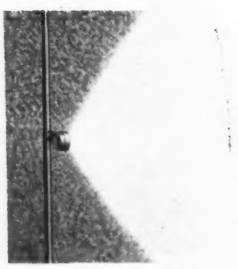

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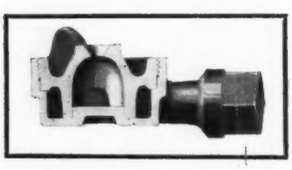

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No. 4

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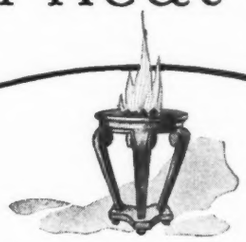
The Progress of Heating and the Prevention of Heat Waste

Second of a Series



FIRE KEEPING

And Carriers Of Fire . . . .

Gradually, through thousands of years, man learned to carry fire for heat to places where he needed it; and "kept" it by feeding it fuel religiously. That process and formality suggested the brazier which later developed, and in some parts of the world still is used today. Here in America now ample heat is every-where in a building, conveyed through its modern channels from a central bed of fire. Where in the olden days 'twas greatly the lack of sufficient heat, today the tendency is severely toward overheating. Where the ancients found fuel difficult to utilize, today fuel is wantonly wasted. However, The Johnson System of Heat Control, established in 1885, automatically regulates the temperature of each room—separately and at the degree the individual room requires, night and day: and likewise reduces usual fuel consumption 25 to 40 per cent annually—a leading, essential part in the progress of heat and the prevention of heat waste.

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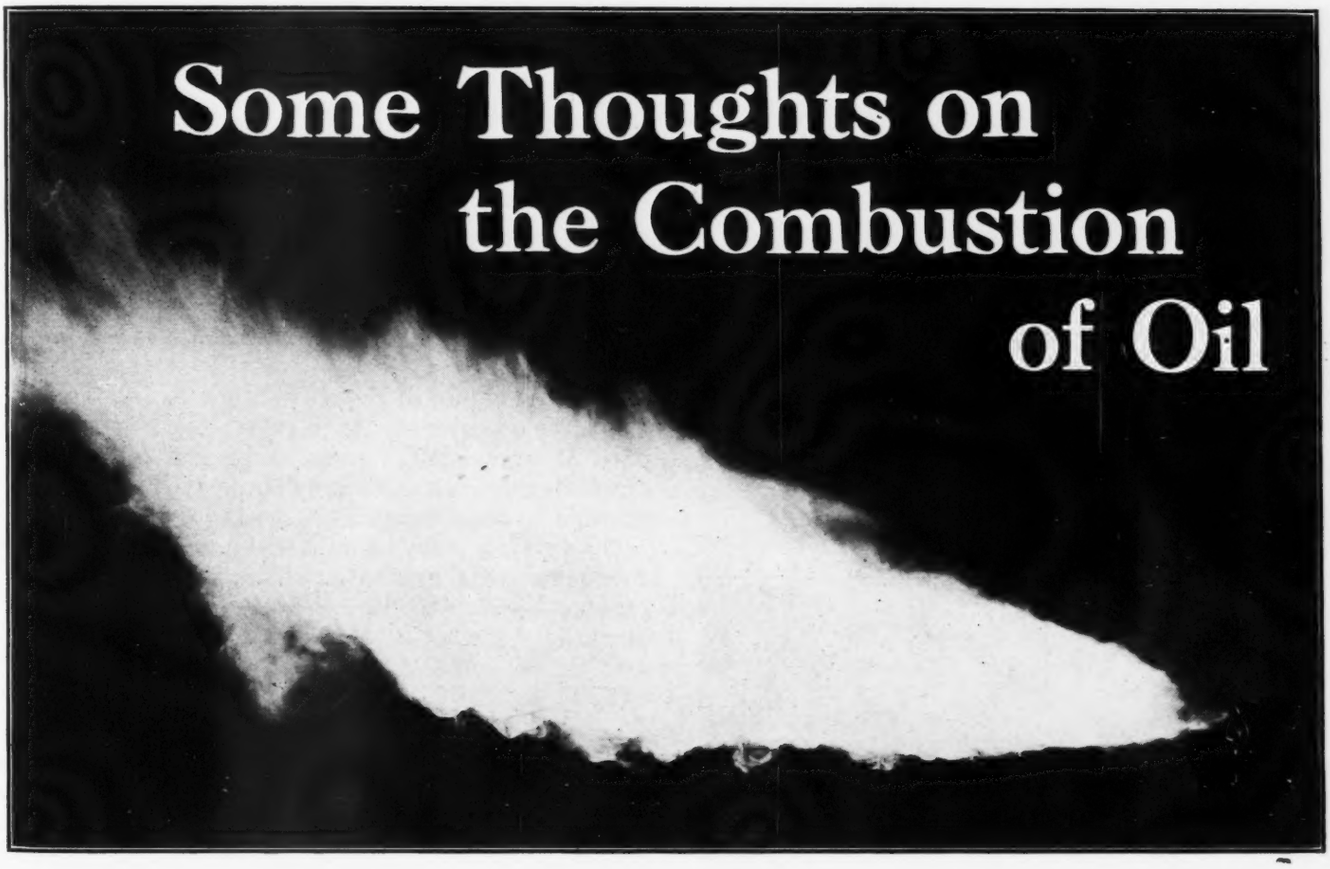
Some Thoughts on the Combustion of Oil



By P. E. Fansler

Associate Editor, THE HEATING AND VENTILATING MAGAZINE

BURNING oil in the home heating-plant presents a problem that is attracting a great deal of attention from the Pacific Coast to the Atlantic, and the inventive ability of American engineers is evidenced in the many methods that have been applied to accomplish a given end.

It is unfortunate that the technical knowledge of those at the foundation of the industry is not reflected in the literature that is being sent out by the various manufacturers; the puerile piffle that characterizes much of the printed word is a disgrace to the intelligence of the average high-school boy.

The campaign against "loose sales talk" instituted by THE HEATING AND VENTILATING MAGAZINE just a year ago was instrumental in eliminating much of the meaningless word-coinage that threatened to become a mill-stone about the neck of the oil-burner industry. Another forward step, at this time, will, I am sure, add to stability in this rapidly growing field and lop off another slice of sales resistance.

The crime of the present day consists in the promulgation of erroneous ideas regarding the combustion of oil fuels in the home, either from lack of knowledge, or, what is far worse, through careless or willful misrepresentation. The oil-burner industry is attempting to sell the idea of heating with oil fuel to the heating industry, to architects and other professional men, and to in-

telligent business men—and the printed presentation is, in many cases, technically unsound and even worse. The efforts of nine salesmen out of ten are handicapped in the same way.

HOW MUCH CO_2 DO YOU WANT?

Imagine having a salesman tell you that his burner would "give you all the CO_2 you want." What would you think of a salesman garbed in a hundred-dollar suit of clothes, in a handsome salesroom, flanked with palms, telling you that "this burner gets 90% efficiency out of the oil it burns while the best that any other burner, using cheap oil, can do is 45%." Think of attempting to sell thousand-dollar burners with such tommy-rot.

It is time to educate salesmen in the fundamentals of oil combustion so that they can do constructive work rather than call forth derision. It is time to establish a new and sound technology in place of the fantastic word-spasms of the past.

The orthodoxy of today is based upon these unsound alleged "laws" of combustion, and must be replaced.

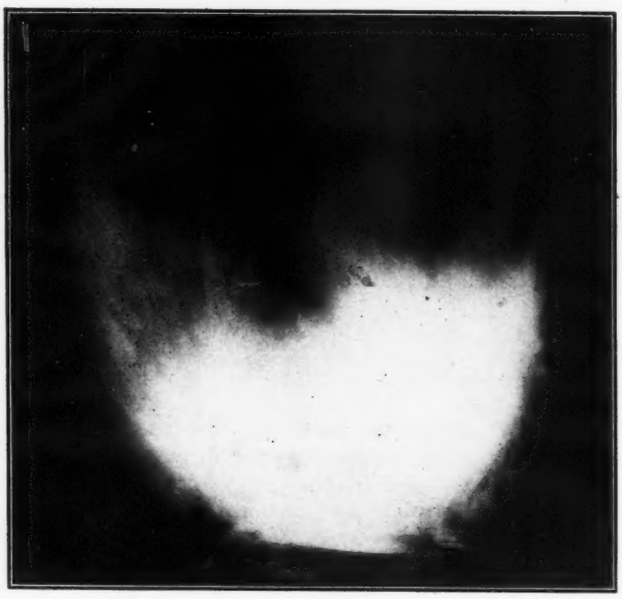
Let us set down a few facts that, in most cases, controvert the orthodoxy of the industry and, if the old order does not stand the searchlight, let it be wiped out and buried as bad medicine.

Here are some hard-boiled facts:

Oil fuel, as such, will not burn.

Oil fuel, when atomized, as such, will not burn.

It is not necessary to atomize oil in order to secure efficient combustion.



Flame Produced by Pot-Type Burner Using Flue Gases as Diluent to Reduce Velocity of Flame Propagation

Oil cannot be burned in suspension.

There is no necessity for mixing oil and air—in definite proportions, or at all.

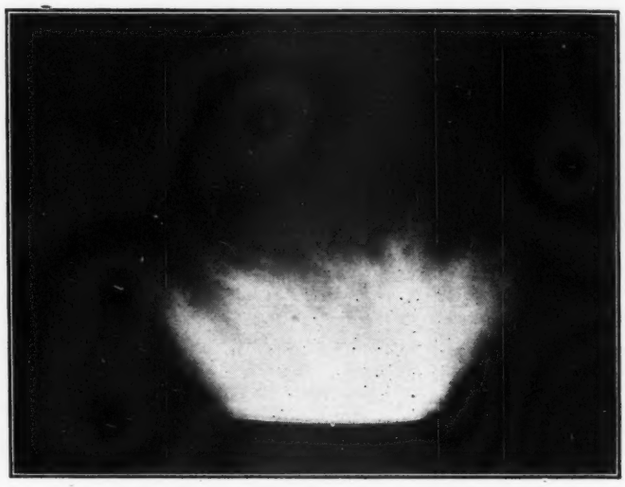
Every oil burner requires a combustion pot.

A fire-pot or combustion chamber as an integral part of a burner is not essential.

Let us take, in turn, these statements that wreck the foundation upon which much of the past oil-burner literature and educational (?) work has been predicated, and build up a clean-cut conception of oil-combustion technique.

OIL FUEL, AS SUCH, WILL NOT BURN

There are three elementary fuels, and only three. All fuels can be considered, from a chemical stand-



Flame Produced by Pot-Type Burner

point, as made up of the elementary fuels. Two of the three elementary fuels make up the greater part of our natural fuels—coal and oil—or are direct derivatives of them. These are: carbon and *gaseous* hydrocarbons.

Oil fuel is, as we know, a *liquid hydrocarbon.* As such, it will not burn. *Heat it to the point of gasification, and it becomes one of the three elementary fuels.* Could anything be more simple?

OIL FUEL, WHEN ATOMIZED, AS SUCH, WILL NOT BURN

If liquid hydrocarbon, as such, will not burn, but must be gasified before combustion can be accomplished, it is obvious that finely broken-up or so-called atomized oil will not burn, *regardless of the size of the particles.* Thus the statement that "Oil must be burned in suspension" is, literally, untrue. Oil cannot be burned in suspension, or any other way. *It must be gasified.*

Atomizing oil is merely a step whose objective is to vastly increase the surface of any given quantity of oil in order that gasification more rapidly can be accomplished.

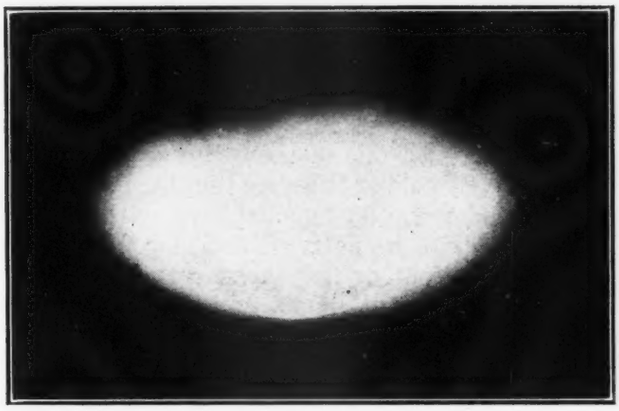
IT IS NOT NECESSARY TO ATOMIZE OIL IN ORDER TO SECURE EFFICIENT COMBUSTION

From what has been said, it is axiomatic that atomization is but a desirable (in most cases) preliminary step preceding gasification. That it is not necessary is evident from the fact that vaporizing burners in small sizes have been in successful operation for many years, and, as will be shown later, some of the so-called atomizing burners of

large sizes are, in reality, gasifying burners, and when in normal operation, probably do *not atomize at all.*

OIL CANNOT BE BURNED IN SUSPENSION

This follows from the foregoing. What is really meant is that, when oil has been converted into gas, this gas is unstable and must be kept above the temperature at which it liquefies. If it is allowed



Circular Flame From Pot-Type Burner

to impinge upon surfaces below that temperature, it will reliquefy, and "cracking" may result, with the deposition of carbon.

THERE IS NO NECESSITY FOR MIXING OIL AND AIR

This thesis follows what has just been said. It is necessary to have a sufficient supply of air and to *mix it with the gas distilled from the oil.* Oil cannot mix with gas, being a liquid. One burner may gasify the oil and bring the air into the gas after the ignition temperature has been reached. In another, the gas and air together may be brought to the point of combustion, in which case a non-luminous flame will result.

EVERY OIL BURNER REQUIRES A COMBUSTION-POT

This statement requires some qualification, as is evidenced by the beautiful flame photographs here reproduced; however, considered as a practical matter, it stands. Some of these pictures were made in mid-winter, in the open air, but the ability of a burner to produce combustion under these conditions does not mean that the conditions are ideal. They are not.

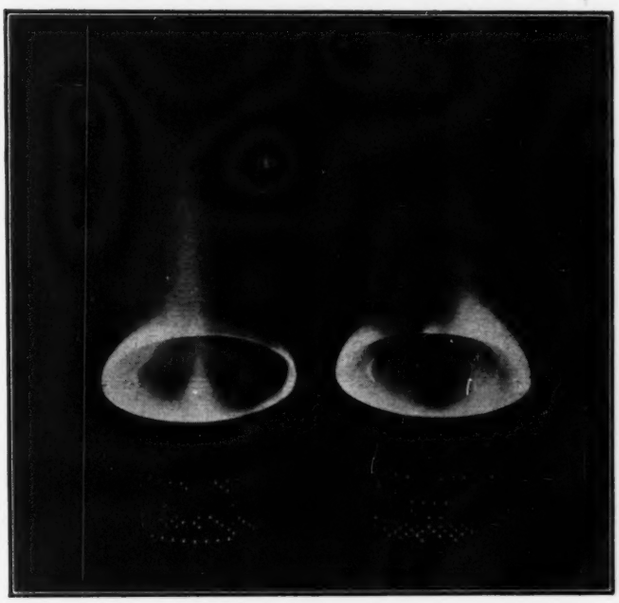
Combustion of oil fuel requires, first, the gasification of the liquid fuel, and this requires heat. More heat must be applied to the gasified oil and to the incoming air, to raise them to a temperature where sustained combustion is attained.

Now, consider the flame of a gas stove. The gas issues from the burner holes in stable, gaseous form, already mixed with air. It is merely necessary that heat is not taken from the flame so fast that combustion fails through reduction of the gas-air-mixture temperature to a point below the ignition temperature.

In an oil-burner flame the same analysis holds, with the important addition that enough heat must be held back, near the ignition point, *to convert the incoming liquid hydrocarbon into gaseous form.* This is the reason for requiring a "fire-pot" or "combustion-pot" in some form—the oil-burner, in addition to being a burner, is a gas-making machine, and must have a retort in which gasification can be accomplished under complete control.

Intermittent operation assumes many starting operations, and it is desirable to assist, in every way, the starting functions.

At first glance, it might be thought that, when starting, appreciable time is required before the emission of radiant heat, from such refractory materials as may be used, becomes effective. Quite the contrary. Radiant heat is quite a speedy traveler —186,000 miles a second—and, in moving within the confines of a little house-heating boiler, the time element might almost be forgotten. If there is a flash of flame, the radiant emission from its surface strikes the refractories *instantly,* and some portion is *instantly* hurled back into space and heats the incoming oil-air mixture, bringing about gasification. It is this flashing back into the combustion volume of the radiant heat emitted by the flame that constitutes the real value of the refractories.



A Hot Flame From a Direct-Gasifying Burner. There is So Little Luminosity In the Flame that it Photographs Poorly

A FIRE-POT OR COMBUSTION CHAMBER AS AN INTEGRAL PART OF A BURNER IS NOT ESSENTIAL

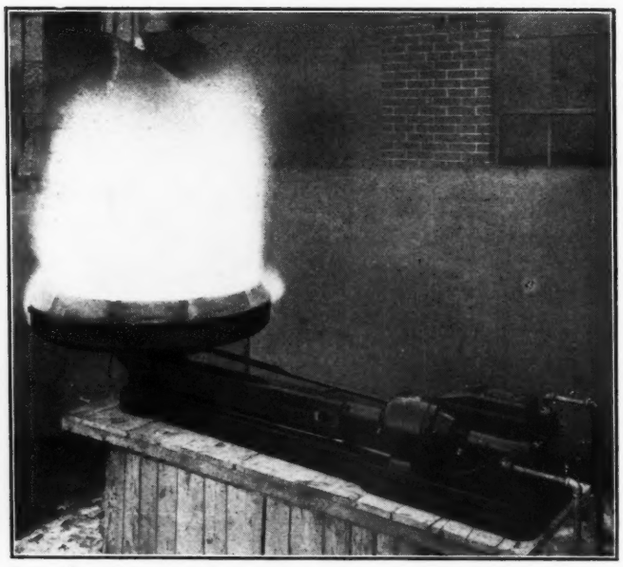
From what has been said it does not matter whether the fire-pot is a little restricted pot attached to the burner, or a shell of brick, lining the lower part of the boiler space. Naturally, the combustion-pot must be suited to the flame, and it is to attain this end that one is one way and one another.

Gasification can be accomplished direct, that is, by distilling the oil into its gaseous form from the

surface of the liquid. Or it can be accomplished by first breaking the oil up into minute particles *and then distilling these particles.* Permit the reiteration of this fact—*atomized oil, as such, will not burn.* Furthermore, it is very probable that, in some burners that set out to be "atomizing burners," these two methods are merged in an undefinable way.

HOW OIL IS GASIFIED IN A VAPORIZING-TYPE BURNER

In a vaporizing burner, which may be either an atmospheric or power type, oil is caused to flow over a hot surface in a thin sheet. The surface need not be very hot, because gasification is the result of reflected heat from the flame. The thinner the layer of oil, the more rapidly will it gasify. When such a burner is being started, the plate is always heated by some supplementary flame, but when in full operation it is probable the plate is not heated as the radiant heat from the flame above it is absorbed by the film of oil, and does not reach the plate to any marked degree, except where it is not covered by the oil. The limitation imposed upon this type of burner is that of capacity. A 75 h.p. boiler probably represents the maximum



Combustion Out-of-Doors With a Horizontal-Disc Atomizing Burner

load for a burner of this type, while the limit of boiler capacity that could be secured with a single "gun" type burner is well beyond 1500 h.p.

The importance of the part played by the radiant heat from the flame produced, in gasifying the incoming oil, certainly is not appreciated as it should be. Radiant heat impacting on a film of oil imparts its energy to the oil *instantly;* that is, in terms of human understanding.

HOW OIL IS GASIFIED IN AN ATOMIZING BURNER

The easiest way to gain a correct comprehension of the way in which gasification is accomplished by a burner of the atomizing type is to picture what is taking place when such a burner is in normal operation.

Consider an extremely simple atomizing scheme —that patterned after the common dressing-table atomizer. Here air, under the requisite pressure, is blown across the top of a tube, the lower end of which dips into a reservoir of oil. The oil is blown from the end of the tube in a fine mist; it is "atomized" in oil-burner parlance, although it certainly is not in the chemical sense; neither is it reduced to molecular units, but just into minute globules.

THE FLIGHT OF AN OIL GLOBULE

Forgetting all else, follow the course and transformation of just one of these tiny globules of oil. It is relatively cold as it leaves the tip, and probably is in the form of a flattened sphere, with the short axis in line with its path of motion. Down ahead, perhaps only four or five inches away, is a seething mass of radiant flame, emitting radiant heat at a high rate. This flame has spread out, filling the combustion volume of the boiler so that the globule of oil not only receives this radiant heat from the front, but from the sides.

It must be remembered that radiant heat is emitted only from *surfaces* and that it acts only on surfaces; *it does not penetrate matter.* So our little globule of oil has its *surface* acted upon, beginning the *instant* that it emerges from its dark nozzle into view of the flame of the burner, *or into the line of impact of radiant heat being emitted from hot refractory materials* that may be used, either in a restricted fire-pot or as a lining to the combustion chamber of the boiler. Radiant heat is also being emitted from all hot parts of the inside of the boiler, but the surfaces of the flame and of the refractories are so much hotter, by comparison, that these effects can be disregarded.

Immediately, then, the larger portion of the surface of the globule is heated to such a point that an oil-gas envelope is formed around it. The globule is moving at a velocity that readily can be computed, but loses velocity just as a rifle bullet does after it leaves the muzzle of the gun. The formation of the gas envelope adds to the retardation, as it increases the diameter of the moving mass; cold liquid in the interior, and hot gas on the surface.

One more assumption must be made to bring about the next step in the transformation that is taking place. We must assume that this globule is not in contact with any other globule; that it is surrounded by air. This air came from the same nozzle that ejected the globule, but, as its mass is less than that of the oil, it will lose velocity more rapidly. And the globule, moving the faster, will have its gaseous envelope literally pulled off from its surface. The removal of the gas enables the radiant heat to make a fresh assault on the liquid surface, for radiant heat is absorbed by but few gases, and at comparatively low rates.

So another envelope is formed, this time more rapidly, for, in diminishing in size, the globule re-

duces its volume; its volume varies as the cube of the radius, while the area varies as the square of the radius. This means that, when the diameter of the globule has been reduced to *one-half* of its original size, it will contain only *one-eighth* as much oil but will have *one-fourth* as much surface. So, as it progresses, constantly having its surface distilled into hydrocarbon gas, which is as rapidly removed, it literally melts away.

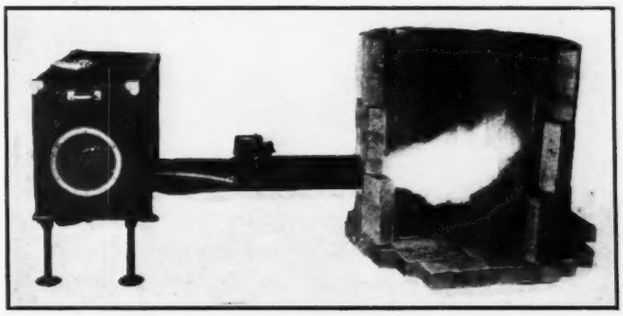
HOW THE COLOR OF OIL AFFECTS GASIFICATION

It is difficult to attempt to show the flight of such a globule of oil, as pencil or pen lines do not lend themselves to such portrayal. But a visualization of what happens is comparatively easy, if only known physical and chemical facts are adhered to. Here is another angle from which the picture may be viewed, injecting another thought: Assume two globules of oil, one kerosene and one dirty, black low-grade oil, flying along, side by side. Which will be entirely gasified first? If the two globules had the same distillation temperature, the heavy oil would, of course. That is because a black body is more receptive to radiant heat than is a white body. This statement must not be taken to mean that such heavy oil can be burned more readily than kerosene, because such is not the case. The oil first must be atomized, and the process of atomization of heavy oil is much more difficult than that of light oil, owing to the difference in viscosity. But that is another problem.

When we consider the rapid advances that have been made in the technique of burning powdered coal, it is seen that this progress is the direct result of the application of basic laws of mechanics, physics and chemistry. The flying speck of powdered coal, blown from a nozzle, much as oil is blown, is acted upon in exactly the same way as the globule of oil. The volatile oils in the fuel are distilled out, and only the remaining carbon is left. By this time the temperature of the carbon brings about its oxidation into CO or CO_2, and the ash falls to the ash-pit. If any demonstration of the existence of a Supreme Being were desired, it could be found in the simple fact that coal is black. Were it white, this utilization of the forces of nature would not be possible, for the radiation absorption ability of dull coal may closely approach the ideal, 1.0, with which the perfect "black body" is designated, while the coefficient of polished silver, a close approach to white, is but 0.03. So it would require a travel of nearly a yard in which a speck of white coal would absorb as much radiant energy as would a similar speck of black coal in moving an inch.

THE MECHANICAL MIXING OF GASEOUS HYDROCARBON AND AIR

The gasification of the oil globule thus being accomplished during its flight, it remains to be seen what has happened to the gas that has been formed. Although little definitely is known of the detailed physical conditions under which the combustion of these flying oil particles takes place, it is safe to surmise that any globule is moving faster than the surrounding atmosphere, whatever that may be. One of the functions of the burner is thoroughly to mix the hydro-carbon gas with the oxygen-bearing air, and this function may be well or ill carried out according to the type and design of burner, its individual setting, *and the conditions of "wind and*



Combustion from Atomizing Burner with Blast Tube, produced in Temporary Combustion Chamber

weather." In other words, there is an uncontrollable variable, this last factor, that entirely precludes the general statement that "this burner secures an absolutely uniform and complete mixing of oil and air."

Assuming, then, that the globule under observation left the nozzle with air (also from the nozzle) entirely surrounding it, there remains to be accomplished the intimate mixing of the gas and air, and the bringing of this mixture to such a temperature as will permit sustained combustion. Bear in mind that the air that is moving into the flame zone is not heated by virtue of the radiant heat emitted by the flame. It does not absorb the radiant rays. The hydrocarbon gases may, to a limited extent, absorb radiant heat, but the factors are not well defined. It then remains for the air to be heated by convection, and the burner that is so designed as to facilitate this operation is, of course, a superior mechanism. As this kind of heat transfer is affected through contact of films or surfaces, it becomes evident that turbulence is a desired condition. Various means, some effective and some of little avail, are provided for this end. Stratification is the enemy of proper combustion, and is sure to occur if sufficient turbulence is not induced.

Turbulence must not be thought of in terms of "a whirling, twisting, tornado-like flame," to quote from an ancient oil-burner catalog. Such turbulence may be spectacular but not efficient. The turbulence desired is the minute mixing of newly-formed gas with air, involving movements that may be but thousandths of an inch. Such turbulence may be taking place in a flame that, to the eye, shows no sign of interior agitation. So we cannot depend upon the eye to give evidence of turbulence. Research work in the combustion laboratory is highly desirable to clarify the technique of this phenomenon, as it is of vital importance to the oil-burner manufacturer.

Original Design Data for Theatre Air Cooling

Proven Methods of Figuring Ventilating and Cooling, Based upon an Experience Covering Some of America's Best-Known Theatres

By S. L. Goodwin

Air Conditioning Engineer, Office of Thos. W. Lamb, Architect, New York

Part II

ONE-QUARTER of all the air supplied to the auditorium should be fresh air and the remainder—or three-quarters may be recirculated. The fresh air and a portion of the recirculated air is drawn through a dehumidifier and cooled to the required saturated temperature, after which it is reheated to the final temperature by mixing with the balance of the recirculated air. Figs. 2 and 3 illustrate a practical application of this scheme to an existing theatre.

It is a most important essential that the air entering from the ceilings be evenly distributed. This is for the reason that cool air naturally has a tendency to drop and will flow vertically down instead of mushrooming and distributing itself horizontally. If corners are neglected, it will often be found necessary to install additional ceiling perforations over these areas after the system is put into actual operation.

Supply air should not be blown into a plenum chamber for a downward ventilating system but, instead, should be carried to each and every outlet by a tight system of ducts, with a separate connection to each outlet.

In some of the early theatres employing air cooling the upward method of ventilation was used, but stratification difficulties developed where this was attempted. The cold air, blown into the plenum chamber under the orchestra, would stratify, resulting in the warmer air seeking the higher outlets in the rear. The cooler air then poured out of the lower outlets near the front. This resulted in unequal temperatures at the front and rear of the auditorium.

Also cooled air, when supplied to the plenum chamber for the purpose of cooling the balcony occupants, would roll down the balcony incline and collect at the lowest level, leaving the top of the balcony too warm.

Tempered air will not only stratify horizontally, according to temperature, but will likewise stratify in a vertical plane. For instance, if air enters two sides of a double-inlet fan, at different temperatures, the fan will often deliver air into the distribution duct at different temperatures. In that case the branches leaving from the left-hand side of the main duct will carry air of a different temperature from those leaving on the right-hand side.

Thos. W. Lamb, Architect
S. L. Goodwin, Heating and Ventilating Engineer

Loew's State Theatre, Memphis, Tenn.

This theatre, seating 3500, is ventilated by centrifugal fan and air washer in basement, and disc fans at roof. Summer cooling effected by air washer (humidifier) in basement, using artesian well water.

Refrigerated theatres must employ recirculation for without this arrangement the cost of operation would be absolutely prohibitive. As previously stated, the amount of air recirculated is about 75% of the amount supplied. To put this another way, about 25% more air is supplied to the auditorium than is exhausted.

This will result in putting a pressure on the house which will aid in keeping out the heat in summer and, to a large extent, will prevent the infiltration of cold air during the winter. Recirculation actually reduces the winter coal bill about 40%.

COST OF OPERATING A COOLING SYSTEM

As an example of just what cooling means in dollars and cents, a typical New York theatre may be taken as an example. In this theatre there are 3000 seats and the remodeling and installation of air cooling required an initial expenditure of $75,000.00.

Working out the cost per week and assuming the life of the plant as only ten years, gave the following figures:—

	Cost per week
Depreciation 10% per annum divided into 16 weeks during the cooling season....	$470.00
Gas	50.00
Electric Current	500.00
Water	250.00
Services of two engineers.....	116.00
Total cost per week.....	$1386.00
Total cost per day.....$1386.00/7	$198.00

With an average admission of 65c per person, and 4 shows per day, this will require the sale of extra seats as follows:

$198.00/(.65 x 4) or 198.00/2.60, which is 78 extra seats in a theatre with 3000 seats available.

After this system was installed, the owner reported that there was no question as to cooling being a profitable investment.

LOBBY TREATMENT

Where lobbies of unusually large size are encountered, the installation of a separate fan and dehumidifier is advisable. With the lobby of ordinary size, however, a separate supply duct may be run to, and connected with, the ceiling inlets. In the winter the lobby requires a separate fan and heater and, if of very large size, two sources of heat should be supplied. One of these sources should be through floor grilles near the outer door with the entering air at a temperature of 120° F. and the other through ceiling grilles with the entering air at about 70° F., both being thermostatically controlled.

INRUSHING COLD AIR AT ENTRANCES

It is quite a problem to prevent an inrush of cold air at the lobby doors during winter weather. This is because there is about 500,000 cu. ft. of 70° F. air in the auditorium which is considerably lighter than the outside air at a temperature of 20° F. or even lower.

Owing to the fact that the warmer auditorium air has about 10% greater volume per pound, it is lighter than the outside air, and therefore, tends to rise. The minute the lobby doors are opened, the cooler air from outside rushes in to the point of lesser pressure existing at the floor of the auditorium.

The only known way to overcome this tendency and to eliminate such draughts, is to balance up the air pressure by an excess of air in the auditorium, combined with the use of heaters with floor registers in the lobby near the exterior doors.

STAGE HEATING

In most of the older play-houses the stages are without anything like adequate heat and are as cold as well as exceedingly uncomfortable. With the light clothing and draperies now being worn by the feminine performers this is very unsatisfactory and is even dangerous.

Most stages are about six stories high. The warm air rises around the outer walls, crosses on the ceiling, where it is cooled, and then falls down in a cascade of chilly air to the top of the proscenium arch, where it spreads out into the auditorium and drops onto the forward seats in the orchestra.

Of course, the stage heat loss should be figured for the walls, roof and skylight in the regular way, but the number of air changes assumed per hour is entirely arbitrary.

Not less than one air change should be figured for the stage and sometimes even this is too little. At times when the curtain is raised for performances, the amount of heat as above computed may be too high, so it is very desirable to control the stage radiators by thermostats.

In the morning, when the cleaners and theatre employees are working, the stage heat will be suffi-

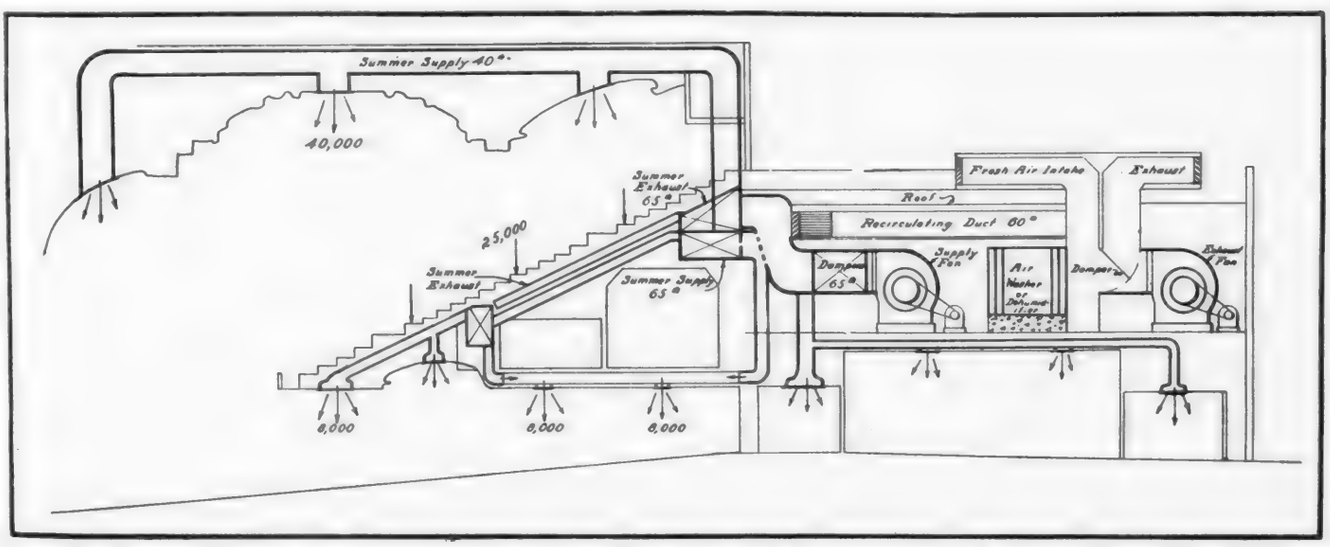


Fig. 2. Arrangement for Cooling a Theatre with One-Quarter Fresh Air and Recirculating Three-Quarters

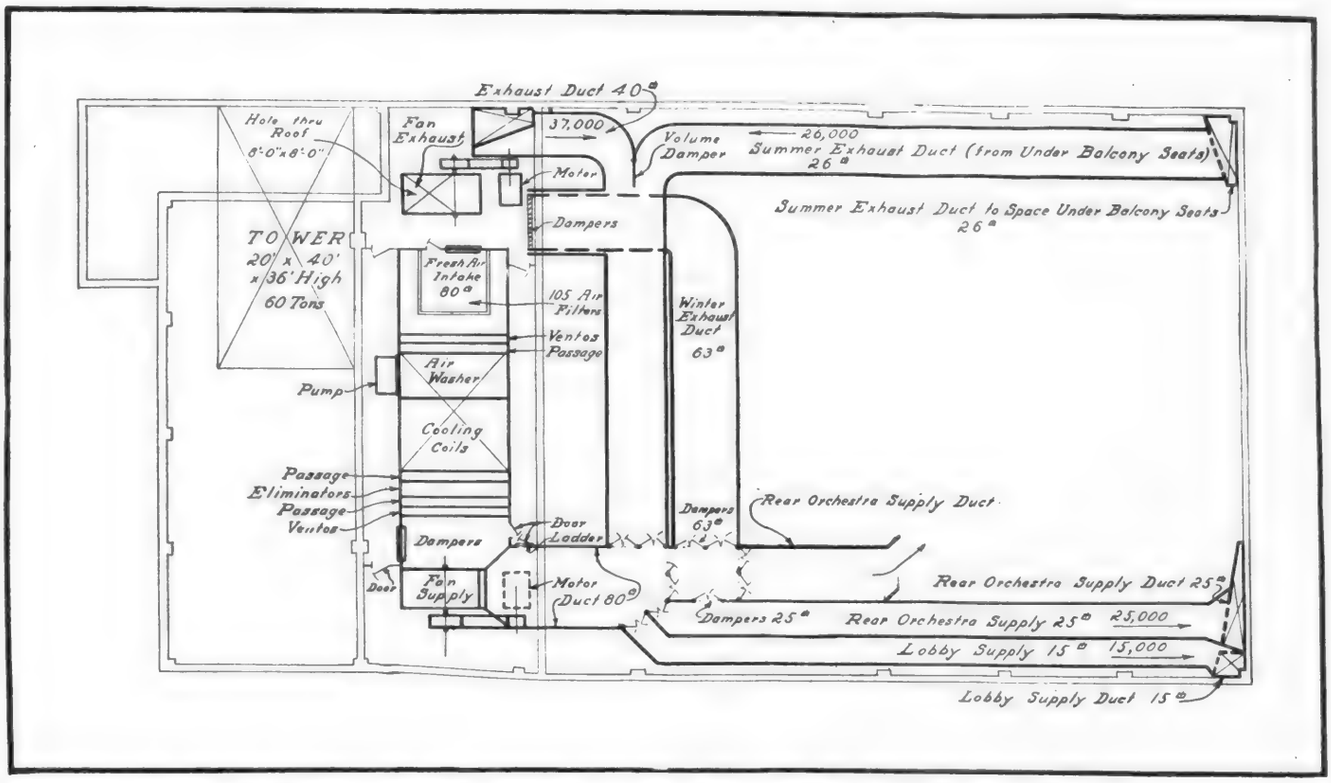


Fig. 3. Arrangement of Ventilating System for Heating in Winter and Cooling in Summer

cient to temper the auditorium without the use of the fan. Usually there will be no direct radiation used in the auditorium proper.

COLD SPOTS

In most theatre designs there are two stairways leading to the boxes, one at either side of the auditorium, near the proscenium arch. A cold current of air falls at these points and should be neutralized or counteracted in some manner by direct radiators. If there are long passages to the exit doors from the auditorium, these passages should also be warmed with direct radiators.

PROJECTION BOOTH

Our lawmakers are splendidly wrong in their rules for the ventilation of projection booths. The modern powerful projectors, spot lights and generators transmit intense heat and dangerous gases. Sickness is quite common among the operators. To properly ventilate such booths a fan should supply sixty air changes per hour (one air change per minute) with a mixing damper to allow cold outdoor air or warm air from the auditorium to be used.

This air should be introduced into the booth at the four corners of the room near the floor and exhausted at the ceiling to allow complete circulation. A separate small duct should connect to each individual projector to draw off the objectionable gases.

AUTOMATIC CONTROL

Varying exterior temperatures and fluctuations in attendance necessitate automatic temperature control of the heat in the winter season, with automatic dampers in the fresh air and recirculation ducts. As the exterior air is cold in winter and too warm in summer, the entire automatic control system must be changed over and reversed in operation in order to meet the requirements of the two seasons.

Thermostats should be placed in the auditorium to control the dampers and heaters, and a thermostat should also be located in the supply-fan duct to supply air up to a minimum low temperature so as to avoid extreme changes in the incoming air.

VENTILATION BETWEEN SEASONS

Operation of a refrigeration plant at any time is an expensive proposition; during the spring and fall and for many of the cooler summer days the theatre can be satisfactorily cooled and ventilated without the use of any refrigeration. This is accomplished by omitting the recirculation altogether and by blowing 100% of fresh air into the auditorium, while the exhaust is discharged into the outside atmosphere.

DEHUMIDIFYING

Every refrigeration plant which lowers the temperature of the air passing through it to below the dew-point is a dehumidifier, because in so doing it removes some of the water from the air. Contrary to the general claims made by a number of people, physical comfort can be found both above and below the standard percentages of humidity. For instance, if one walks in his garden on a midsummer morning with the thermometer at 70° F.

and the humidity at little less than saturation (as the dew had stopped falling at sunrise), the air is found to be clear, cool and comfortable.

Yet, in another case, in a theatre, the air left the dehumidifier at 64° F. saturated and rose to 72° F. in the theatre with no discomfort from humidity.

Comfort, therefore, is not the result of either temperature or humidity alone, but is obtained by a combination of both. When the temperature is low, the humidity can be raised and, when the temperature rises, the humidity must be lowered to maintain a comfortable condition.

DETERMINING HUMIDITY BY USE OF RECIRCULATED AIR

Some time ago, the writer evolved a scheme of establishing the amount of humidity, as shown diagrammatically in Fig. 4, by by-passing a portion of the recirculated air around the cooler and mixing it with the cooled air at the fan. As this by-passed air has a higher temperature than the humidified air, by varying the proportions of the mixture, any reasonable percentage of humidity desired can be obtained. Another advantage of this scheme is that the theatre temperature can be controlled by thermostats, operating mixing dampers in the main-flow and by-pass ducts. One of the air conditioning companies claims a prior right to this invention, and has since patented it.

EXPLANATION OF METHOD OF OPERATION

In the diagram shown in Fig. 4, the supply air from the outside is brought into one side of the inlet to the Vento heater and the recirculated air is brought in on the opposite side. When outside air is being used altogether, the outside air simply passes through the Vento heater and air washer to the fan in the normal way.

When recirculation is being operated—assuming 60,000 C.F.M. as the total amount delivered to the auditorium—half of the recirculated air (30,000 C.F.M.) is run through the apparatus and the other half (30,000 C.F.M.) is by-passed around the apparatus, entering the fan suction along with the air which has passed through the air washer and dehumidifier.

If the recirculated air coming back from the auditorium is 80° F. and 54% R.H., then each cubic foot by-passed will contain 6.15 grains of water (adding 0.40 grains for respiration). If the air passing through the apparatus is delivered at 60° F. and saturated it will contain 5.75 grains of water per cubic foot.

We then have

cu. ft.	
30,000	@ 60° F. and 5.75 grains of water.
30,000	@ 80° F. and 6.15 grains of water.
60,000	@ 70° F. and 5.95 grains of water.

At this temperature of 70° F., 5.95 grains is equivalent to 75% R.H.

If body heat in the auditorium raises this temperature to 75° F., the relative humidity will then be 64%.

ANOTHER METHOD OF CONTROLLING REFRIGERATED TEMPERATURE

Refrigerated temperature can also be controlled by five other methods as follows:—

(a) By the use of two compressors; thus, when only a slight cooling effect is desired, electricity may be conserved, as well as machine wear, by using only one condenser.

(b) By a variable-speed control on the compressor motor.

(c) By dividing the condensers into four separate banks, with separate gas control on each bank.

(d) By shutting off one bank of dehumidifying sprays.

(e) By throttling the condenser water valve.

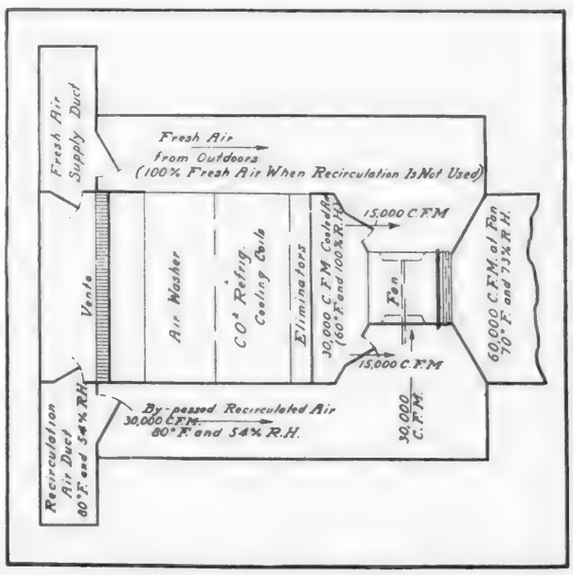

Fresh Air Supply Duct
Fresh Air From Outdoors (100% Fresh Air When Recirculation Is Not Used)
15,000 C.F.M.
Vento
Air Washer
CO² Refrig. Cooling Coils
Eliminators
30,000 C.F.M. Cooled to 60° F. and 100% R.H.
Fan
60,000 C.F.M. at Fan 70° F. and 71% R.H.
15,000 C.F.M.
By-passed Recirculated Air 30,000 C.F.M. 80° F. and 54% R.H.
30,000 C.F.M.
Recirculation Air Duct 80° F. and 54% R.H.

Fig. 4. Arrangement Designed by Author for Regulating the Amount of Humidity in the Air Supply

REFRIGERATING MACHINES

Refrigerating machines, employing ammonia as a refrigerant, should not be used in any place of public assemblage because the ammonia is a great menace. Other mediums are much safer, such as carbon dioxide which will not burn, explode, or cause a panic by diffusion.

Carbon dioxide, however, has the disadvantage of requiring high compression and of not condensing above 88° F. Yet in two theatres operated during last summer—one in Norfolk, Va., and the other in New Orleans, La.,—carbon dioxide apparatus cooled the air to the desired requirements, notwithstanding the high temperatures and humidities obtained in these localities.

One manufacturer has developed a refrigerating apparatus employing diclorethylene gas ($C_2H_2Cl_2$) which has a condensing temperature of about 360° F., and he operates the apparatus under a

partial vacuum. This gas is non-explosive, practically fireproof and is not dangerous when diffused. Several vertical CO_2 machines are also on the market, this design of apparatus requiring less space than the horizontal type.

FUTURE USE OF REFRIGERATION IN OTHER BUILDINGS

Refrigerating plants are undoubtedly going to be adapted for more or less general use in buildings other than theatres, but the rapidity with which this will be effected will be largely controlled by the production of cheaper machines of greater compactness and more simple in operation than the present ones. There is almost a limitless field in which to expand along this line; so far the surface barely has been scratched.

COOLING TOWERS

Cooling ponds or cooling towers should be arranged for in connection with all refrigeration plants. Even though not installed with the plant, their future use must be contemplated. For several reasons, however, it is most advisable to include some method of reducing the cooling-water temperature with every cooling plant. In the event of water shortage during the summer, the theatre cooling plant supply will be among the first to be cut off.

Another consideration is the fact that an increasing number of cooling installations will soon make the water demands impossible for municipalities adequately to supply.

In some instances the street mains will be found to be of too small capacity adequately to serve the building requirements, to say nothing of supplying water for cooling systems.

For all these reasons, it is good engineering either to install a cooling tower with the cooling plant or, at least, to make structural provision in the building for the erection of a tower at some later date.

WATER CONSUMPTION OF DEHUMIDIFIERS

The writer uses the following method to calculate the approximate water requirements for a dehumidifier in gallons per minute per ton refrigeration:—

Allow 7½° F. temperature rise in the water in the humidifier (53°—45½°).

One gallon of water raised 7½° F. requires 62.47 B.T.U.

One ton of refrigeration is equivalent to 200 B.T.U. per minute.

Then $\frac{200 \text{ B.T.U.}}{62.47 \text{ B.T.U.}} = 3.2$ g.p.m. per minute per ton of refrigeration, with a temperature rise of 7½° F. and 100% efficiency.

Some allowance should be made for a drop below 100% efficiency in cooling, say 75%, and not less than 4 g.p.m. per ton should be figured.

The condenser water for the condenser coils, cooling tower or spray pond may be figured by this same method. The allowable rise in temperature, in this case, is fixed by the wet-bulb temperature of the exterior air under summer conditions and the critical condensing temperature of the refrigerating gas used.

Efficiencies of dehumidifier and condenser coils should be tested out and definitely defined by some impartial laboratory—such as the A.S.H. and V.E. Research Laboratory—so as to arrive at a rational and dependable figure. Usually 75% is taken as an average figure for calculating. Spray ponds are not as efficient as cooling towers and the space requirements usually prohibit their use, but the objection to the unsightly towers is bringing them into favor.

Relation of Fusibility of Coal-Ash to Formation of Clinkers

A CO-OPERATIVE investigation for the purpose of determining some property of coal-ash susceptible to reasonably accurate measurement in the laboratory, which would serve as an index to its clinkering characteristics in boiler furnaces, has been undertaken by Carnegie Institute of Technology and the Bureau of Mines, Department of Commerce. The importance of a solution of this problem to consumers and producers of coal is obvious. The investigation was undertaken at the request of the Committee on Coal and Coke of the American Society for Testing Materials.

Seven coals, having ash-fusion temperatures ranking from 2070 to 2930° F., were selected for comparative burning tests in a specially designed hand-fired furnace with a circular grate 20 in. in diameter and water-cooled iron walls.

Although coals are being tested during the present year, and research is required on the relation which exists between the burning of the coals in the small furnace and the various methods used in practice, tentative conclusions have been suggested by the work done during the past year.

The seven coals selected for test in this investigation included bituminous coals from Ohio and Illinois, and semi-bituminous coals from Pennsylvania and Maryland.

The results of this investigation are outlined in Bulletin 29, Mining and Metallurgical Investigations, by W. A. Selvig and P. Nicholls, of the Bureau of Mines, and W. L. Gardner and W. E. Muntz, of Carnegie Institute of Technology. Copies of the bulletin may be obtained from Carnegie Institute of Technology, Pittsburgh, Pa., at a price of 50 cents.

Indirect Radiation for Residences

Essential Points of Design, Including Arrangement of Stacks, Sizing of Ducts, Location of Registers and Air Velocities

By Ernest C. Whitaker

INDIRECT radiators, as installed in residences, are most commonly used for heating. Their selection is generally determined upon so as to avoid the use of direct radiators, which are considered undesirable by most architects and many owners, both on account of the space they occupy and the difficulty of making them harmonize with the architecture and furnishings of the room to be heated.

Owners and engineers may have in mind the desirability of a fresh air supply, but as the residences heated by indirect radiators, as a rule, are of the larger and finer type, and the number of occupants few in comparison to the number of rooms, the volume of space per person is sufficiently great to make outdoor connections unnecessary in the majority of cases.

On the contrary, there is even an objection to the introduction of fresh air, on account of the accompanying dust delivered, this being controlled by the location, wind conditions, and season of the year.

If the indirect surface is to serve for both heating and ventilation, it is well to make, in addition to the warm air connection, two other duct connections, one for fresh air and one a by-pass for recirculating, with dampers so arranged that ready conversion may be made from a ventilating to an indirect heating apparatus when the building is unoccupied, and vice versa.

Where the indirect radiator is used for heating only, the sizes of air ducts (in theory at least), may be comparatively small in relation to the size of the radiator, as it is necessary to heat only a lesser quantity of air to a higher degree of temperature.

When, however, the indirect is to be used for ventilating purposes alone, it becomes desirable to supply a greater quantity of air, but at a temperature equal only to that desired in the room; therefore, the ratio of duct area to radiating surface must be greater than when used for heating only.

No mechanical means are used for creating a movement of air, while several agencies are at work in opposition to the gravity flow. Friction of ducts, in which perfection of design or installation is not always possible, position of registers, wind direction and other atmospheric conditions, all may tend to retard the air current.

Theoretical design alone may not always give perfect results. It is well to keep in mind that a duct once installed cannot be enlarged by damper manipulation, but a duct large enough for the most severe requirements may always be restricted as desired by a damper properly designed.

Air velocity may be pre-estimated theoretically, and after installation, the actual velocity may be measured under all varying atmospheric conditions. But as air movement is one of the least understood, one of the most variable and uncertain phenomena, it is advisable to provide for all contingencies and install ducts of ample capacity.

PROPER DESIGN OF INDIRECT STACK ESSENTIAL

The proper design of the stack or encased indirect radiator, is the first step, and requires that ample surface be provided in the radiator sections, as well as sufficient space above and below, for the unrestricted passage of both cold and heated air.

The inlet air duct for cold air, recirculation or both, should be connected at one end in, or at, the bottom, completely below the radiator, while the warm-air connection should be taken from the opposite end of the stack, either from top or end,

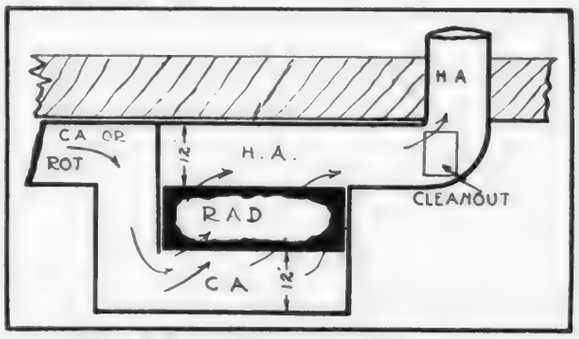


Fig. 1. Typical Indirect Heater and Casing Arrangement

but entirely above the radiator, thus permitting the total quantity of air to pass over the entire radiating surface. The area at air entrance and exit must be of ample size to accommodate the full air passage, and at no point may this area be restricted if the apparatus is to be fully effective.

As a rule, 12 in. above and 12 in. below the radiator is sufficient, but this should always be checked with the quantity of air to be delivered, particularly under conditions of ventilation. (See Fig. 1.)

SECOND PROBLEM PROPER SIZING OF DUCTS

For all stacks, but particularly for those designed for ventilating purposes, it is advisable to provide 2 sq. in. of duct area for each square foot of radiation. Although the difference in density of air at different temperatures permits, in theory,

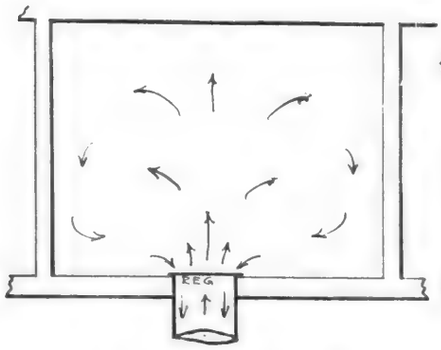


Fig. 2. Air Flow with One-Pipe Furnace

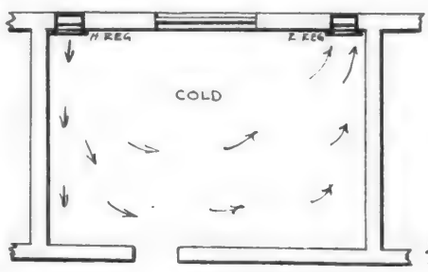


Fig. 3. Plan Illustrating Air Flow with Registers in Cold Outside Wall

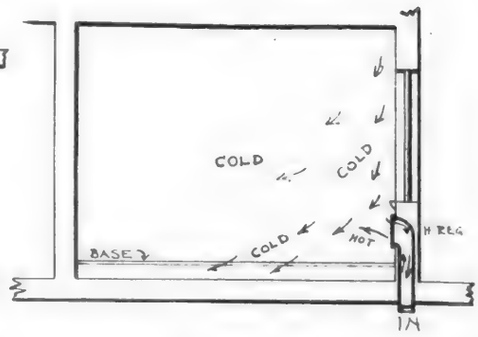


Fig. 4. Elevation Showing Air Flow with Registers in Cold Outside Wall

the use of smaller cold air ducts, it is the writer's opinion that to follow theory to this extent in practical design is unnecessary, and any duct restriction, except by use of dampers, is inadvisable.

CORRECT LOCATION OF REGISTERS

The third important matter is the correct location of registers, which is of paramount importance, particularly if the air is to be delivered to the first floor, only a few inches above the radiator.

Before locating the registers, however, let us picture in our minds, the air in the room as divided into three strata, each blending with the next, but of different densities.

Near the floor is a layer of comparatively cold, dense air, which, due to its greater weight, settles down like so much water, striving to find holes through which it may pour downward still further.

Under the ceiling is a larger layer of camparatively hot air, which is practically motionless, due to the fact that it lays above the top of all doors and windows which could cause a draft.

The third, or middle stratum, is situated in the breathing space, where it is kept constantly in motion by drafts from doors and windows, and by the movements of the occupants of the room.

There are commonly but three register locations to be considered,—first, in the floor, in the lower stratum of air; second, in the wall immediately above the base, in the middle stratum; and third, in the wall above head level, which will probably occur in the upper stratum.

Rotating, or recirculating registers should always be located in the floor, or in the wall close to the floor (not above the base), to permit the colder air at the floor to flow downward most freely.

EFFECT OF LOCATING REGISTERS IN FLOOR

Heat registers should never be located in the floor, as the heated air, in rising, must meet the resistance of the blanket of cold air at the floor, which attempts to flow downward through the opening, with the result that the rising current of warm air is forced to the center, while the area at the sides is usurped by the downward current.

Upon this peculiarity of air flow is based the design of the one-pipe furnace, with its single, enlarged register in the floor, through the center of which the heated column of air rises vertically to the ceiling, while the colder air at the floor passes down the outer portion of the register, to be reheated. (See Fig. 2.)

Neither should heat registers be placed in the upper, motionless stratum of hot air, unless there is some form of exhaust or recirculating outlets at the floor, for without such agencies to draw the heated air downward, the upper part of the room becomes overheated, while the floor may remain cool, a condition of discomfort and dissatisfaction which costs as much to maintain as does an evenly heated room.

REGISTERS PREFERABLY PLACED IN WALL

The preferable location for the heat register is in the wall, above the base, for in such a position the rising current of heated air is enabled to find free passage above the cold stratum and leaves the register in a slightly rising stream. This stream, in giving up its heat to the room, gradually cools, holds a fairly level direction for awhile and then gradually drops, instead of rapidly rising to the already warmed stratum at the ceiling.

Although there has been voiced the objection that the walls above a register are stained by the heat, the large portion of the flow of air from a wall register does not touch the wall, but may frequently be felt at a distance of 6 ft. or 8 ft. away, and tight connections between the register and the flue will do much to remedy this feature.

Another advantage of the wall register is the partial elimination of the unsanitary condition of floor sweepings and falling dust dropping into the duct only to rise again with the current of heated air. Regardless of register location, however, it is good engineering practice to install doors for cleaning, in the stack casing, both above and below the radiator, and similar doors should be located in all ducts beneath the registers.

In addition to the consideration given to the vertical location of the registers, some thought should be given to the horizontal position.

HEATED AIR SHOULD BE DIRECTED TOWARD EXPOSED WALLS

Heat ducts situated in outside walls, however well insulated, cannot be expected to be as efficient

as those located in interior partitions, as the effect of the cold wall will lessen the velocity of the rising current of air, which, upon leaving the register, will also be directed away from that portion of the room most necessary to be heated. (See Figs. 3 and 4.)

The correct location should be in the partition opposite the exposed wall, particularly if no recirculating register is provided, as the current of heated air will then be directed toward the exposed cold wall. (See Figs. 5 and 6.)

When a recirculation register is installed, however, it is permissible to locate the supply register in an inside partition, fairly close to the exposed wall, and the return register in the opposite partition, also near the exposed wall, thus permitting the current of heated air to flow parallel to and near the cold exposure. (See Figs. 7 and 8.)

AIR VELOCITIES

The actual velocities attainable are interesting to note, as they are affected by wind direction and velocity, atmospheric pressures, and varying outdoor temperatures.

In spite of the data frequently used in practice, and given by some authorities, tests have shown that it is unsafe to assume a velocity greater than 150 ft. per minute through registers located in the first floor, and although velocities as great as 350 ft. per minute have been recorded when registers were placed above the baseboard, it is unwise in designing an apparatus, to assume even with this condition, more than 250 ft. per minute, particularly if the air is to be recirculated. As actual tests may be made only after installation, design must be based upon assumption of velocities.

For heating purposes, the velocity must be estimated for conditions when the outdoor temperature is zero or lower, as this is the time when the greatest heating efficiency is required, but when the indirect is to be used for ventilating purposes, it must be considered that the greatest air supply for a crowded church, hall or school may be required when high temperature, high humidity, and atmospheric conditions tend to make the air movement most sluggish.

Frequent attempts have been made to filter the cold air supply to indirect radiators, but if we consider the low natural velocity created by the heated radiator, which velocity is seldom over 350 ft. and sometimes as low as 50 ft. per minute, it will be seen that the slightest increased resistance will stop all air movement.

The least resistant of air filters is, no doubt, the air washer with approximately ¼-in. resistance; while that of the cloth bag type may run from ¼ to ⅜-in. or even greater, depending upon design and care, and the viscous filter may run from 1/3 to ½-in., or even greater, if not properly cleaned.

Air washers are further unsuited for use in connection with gravity indirect heating, for pre-

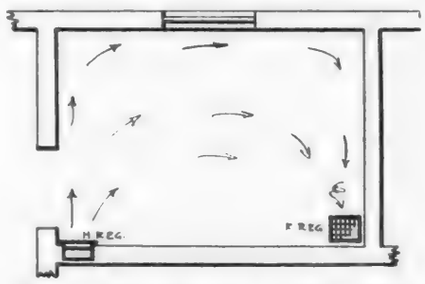


Fig. 5. Plan Showing Air Flow When Directed Toward Cold Wall

heaters must be installed to prevent freezing of the washer, and cold water, overflow, drain and electric connections must be provided. The initial cost, the space required, the added resistance and the maintenance cost of water and electric current make such an apparatus well nigh prohibitive in residence work.

For cloth bag filters the space occupied would be enormous, and tests have shown that it is practically impossible to attain any satisfactory results whatever.

Failures frequently occur in indirect heating, then, due to faulty stack design, undersized ducts, erroneously assumed velocities, improper location of registers, and the inclusion of resisting devices which may so retard the flow of air as to make an otherwise satisfactorily designed system absolutely unusable.

With proper care in design, however, the indirect radiator holds a valuable place in the art of heating and ventilating.

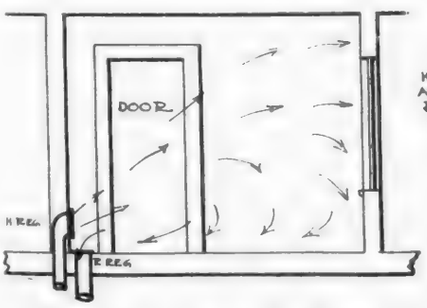


Fig. 6. Elevation of Air Flow when Directed Toward Cold Outside Wall

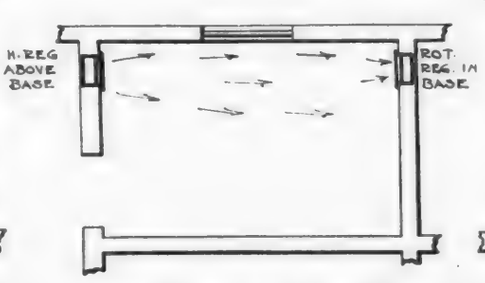


Fig. 7. Plan of Air Flow Parallel with Cold Wall

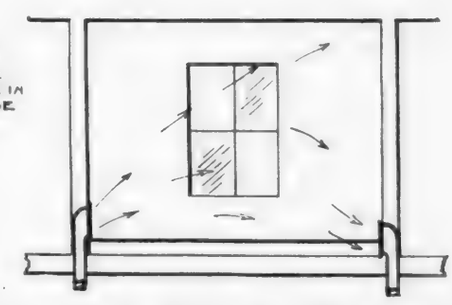


Fig. 8. Section Illustrating Air Flow Parallel with Cold Wall

This is the twenty-third lesson of The Heating and Ventilating Magazine's

New Home-Study Course in Gravity Steam and Water Heating

Lesson No. 23 (continued)—Designs and Reports

By Ara Marcus Daniels

THE preparation of a design and estimate for a steam heating system represents several distinct operations. Comparable bids from several firms cannot be obtained unless the basis for the bids is the same, nor can a correct estimate be submitted for a system of steam heating without first having properly designed the system and prepared a plan from which all quantities of material may be taken and a reasonably safe estimate of labor made therefrom.

Then, again, each job that passes through an office should be done in such a way as to contribute something toward making subsequent estimates more positive as to correctness. Consequently, the more carefully prepared and systematically executed, just so much more will every design give more reliable information. Every business man must develop for himself methods by which he may be a more successful merchant. Various forms for carrying forward a heating design may be developed to suit needs; so, in presenting those that follow, no claim is made that they are ideal or that they necessarily should be adopted by every individual. They are used primarily to teach the student system in handling such work. By employing some similar systematic plan for recording design calculations and estimating costs (to be discussed in following lessons) permanent and oftentimes invaluable records are available.

The work may be grouped under three heads:

(a) Field data as basis for design.

(b) Office calculations for heating requirements.

(c) Preparation of plans for estimate and installation.

A complete design for a vapor heating system for a two-story office building will be carried through in detail. Fig. S-8-6 shows the two floor plans. The student should assume temporarily that the radiators (shown thereon) have not been determined as to size or location.

The first step is to "measure-up" the plans or the building if it is already built, and plans are not available. Table S-8-1 contains spaces for recording all necessary dimensions and for calculating the areas of all surfaces for which heat transmission must be figured. The data contained in this table do not depend upon the type of system to be installed. The correctness of these data is essential else any error therein contained will be carried through all calculations embodying these fundamental design figures. Field data recorded in the manner presented afford easy means for checking. These data when so presented may be collected and compiled by one person and used by another with perfect assurance of understanding.

The second step is to transfer from Table S-8-1 the net areas required. Thus, net areas for wall, glass and door respectively are noted in columns 4, 7, and 10 of Table S-8-2 and linear feet of crack opening around windows or doors used as the basis for infiltration losses listed in Column 16. Net areas for ceilings or floors through which heat may be lost or gained are noted in Columns 19 and 22 respectively. Room designations having been properly filled in, there is included within the same space, the temperature at which this particular room is to be maintained.

Further progress is impossible without detailed data on construction details and operating conditions. It should therefore be obtained and noted in easy reference form, somewhat as follows:

DATA

Walls: Outside, 4-in. brick, 12-in. hollow tile plastered.
Partition, 4-in. hollow tile, plastered both sides.
Windows: Single thick glass, in wood frames.
Door: 1¾ in. T. and G.
Temperature: Outside, 0° F.
Inside (as given in Column 2, Table S-8-2)
Basement, 50° F.
Attic, 40° F.
Exposure Allowances:
North, 25%
West, 20%
East, 10%
South, 0%
Infiltration Data (figured for north and west sides):
Double hung window.
Interlocking-type weather strip.

Wind velocity, 20 miles per hour.

Plain door.

The next step is to refer to proper heat loss coefficient tables (as are given in Lesson 2 of Part 1) and note the value of coefficient "f" for wall, glass, door, ceiling, and floor. Space is provided in Table S-8-2.

Thus, the following values are obtained: For wall, f = 0.18; for glass, f = 1.10; for door, f = 0.42; for inside wall, f = 0.50; for ceiling and floor, f = 0.36. As these values are for B.T.U. per hour per 1° F., the value to use as a multiplier of net area is obtained from the product of the value of "f" times difference in temperature between the inside and outside. Hence the coefficient for Column 5 for room A is 80 × 0.18 = 14.4. Other values in this column as well as those in columns 8, 11, 20 and 23 are obtained in a similar manner.

Work Problem S-8-6

Having these values correctly prepared, the product of the area (Col. 4) × the coefficient (Col. 5) for each wall of each room will show the B.T.U. loss through them as recorded in Column 6. Thus for the west wall of room A, 171 × 14.4 = 2460 B.T.U.

In a similar manner values in Columns 9, 12, 21, and 24 are obtained.

The next step is to obtain total B.T.U. loss for each wall of each room as given in Column 13 by adding the values in Columns 6, 9, and 12. These additions should be made for the respective walls and not for the entire room in order that different exposure factors may be correctly applied. Thus for west wall of room A:

$$2460 + 6320 + 0 = 8780 \text{ B.T.U.}$$

Exposure factors are next noted in Column 14 and then applied and the results recorded in Column 15. Thus, for west wall of room A:

$$8780 \times 1.25 = 10750 \text{ B.T.U.}$$

The value for the infiltration coefficient should next be established. Reference to Table 19, Part 1 shows a value of 1.98 B.T.U. per foot of crack per mile of wind velocity per 70° F. This will be 1.98 ÷ 70 = 0.028 for 1° F. and the value for Column 17 for windows becomes 0.028 × 80 (deg.) × 20 (m.p.h.) = 45 B.T.U. per linear foot of crack opening.

The value for a plain door is 8.36 B.T.U. per mile of velocity per 70° or 8.36 ÷ 70 = 0.12 per 1°.

Work Problem S-8-7

The next step is to total all B.T.U. losses and record same in Column 25. The losses from the respective walls need no longer be carried independently. Thus, for room A, the total hourly B.T.U. loss becomes 10750 + 9640 + 10320 + 2160 + 11350 = 44220 B.T.U. It should be noted in the case of some of the rooms that there is a negative loss. If this is not clear to the student, he should review Lesson 2 of Part 1.

Work Problem S-8-8

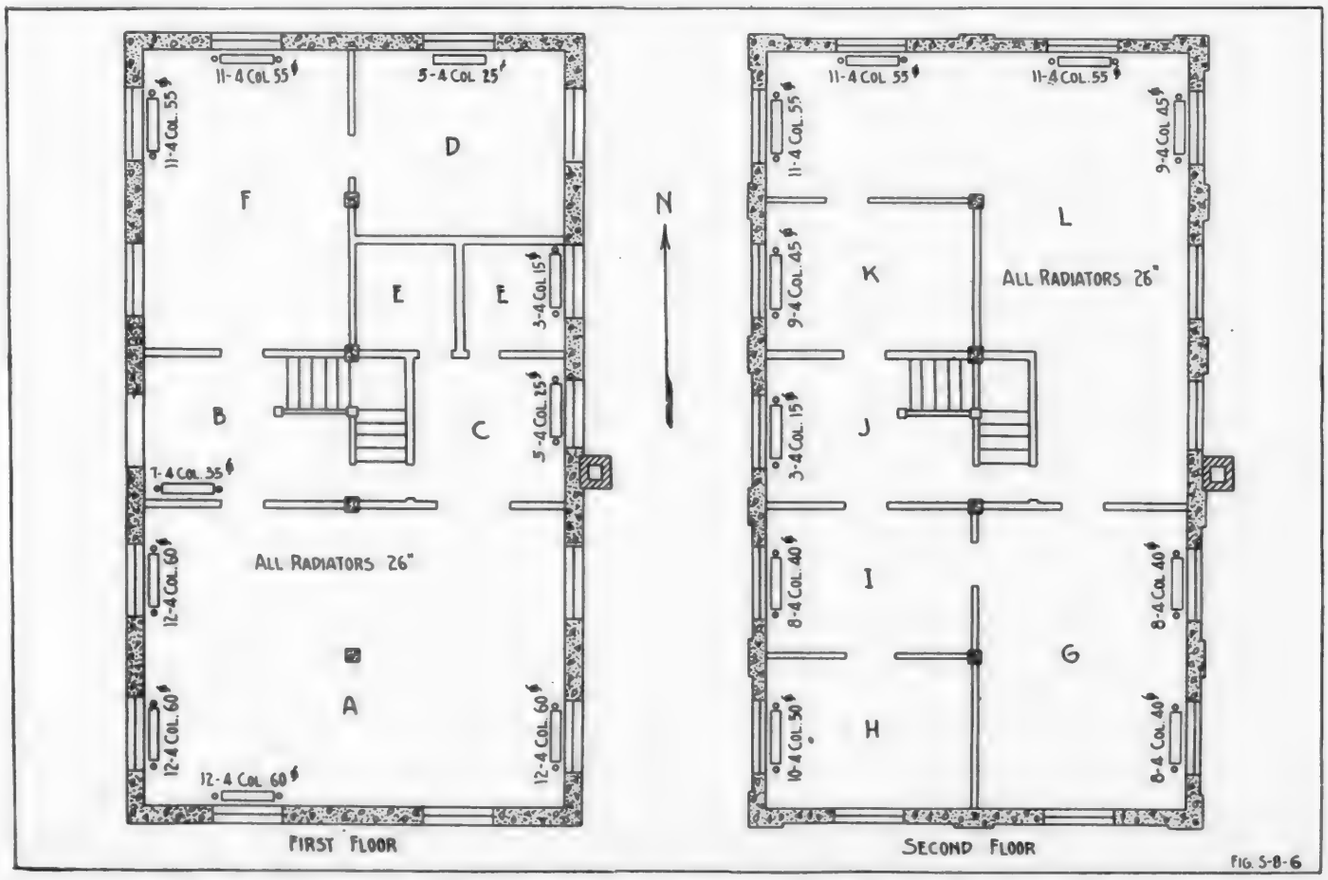


Fig. S-8-6. Floor Plans for an Office Building for Which a Vapor Heating System is to be Designed

TABLE S-8-1. FIELD DATA FOR FIGURING HEATING SYSTEM FOR OFFICE BUILDING

FIELD DATA FOR HEAT LOSS CALCULATIONS

FLOOR.	ROOM DESIGNATION	WALL	GROSS EXPOSED WALL DIMENSIONS AND AREAS SQ. FT.	GLASS AND DOOR SURFACE IN EXPOSED WALLS: GLASS DIMENSIONS AND AREAS, SQ. FT.	GLASS AND DOOR SURFACE IN EXPOSED WALLS: DOOR	GLASS AND DOOR SURFACE IN EXPOSED WALLS: TOTAL GLASS	GLASS AND DOOR SURFACE IN EXPOSED WALLS: TOTAL DOOR	NET EXPOSED WALL AREAS SQ. FT.	INFILTRATION: WALL	INFILTRATION: LINEAR FEET OF CRACK AROUND WINDOWS AND DOORS IN WALLS FOR WHICH LEAKAGE IS CONSIDERED	VOLUME: DIMENSIONS AND CUBICAL CONTENTS CU. FT.	AREAS: FLOOR DIMENSIONS AREAS SQ. FT. (IF HEAT LOSS OCCURS)	AREAS: CEILING DIMENSIONS AREAS SQ. FT. (IF HEAT LOSS OCCURS)
1ST	A	W	27'×9' = 243	2(6×6) = 72	—	72	171		W	2(4×6) = 48	27'×39'×9' = 9450	27'×39' = 1050	—
		E	27'×9' = 243	2(6×6) = 72	—	72	171		—	—			
		S	39'×9' = 351	2(6×6) = 72	—	72	279						
1ST	B	W	13'×9' = 117	—	6×7½=45	45	72		W	2×6 = 12 2×7½ = 15 27	13'×22'×9' = 2580	13'×22' = 286	13'×22' = 286
		–	—	—	—	—	—		–	—			
		–	—	—	—	—	—						
1ST	C	E	13'×9' = 117	6×6 = 36	—	36	81		–	—	13'×13'×9' = 1520	13'×13' = 169	—
		–	—	—	—	—	—		–	—			
		–	—	—	—	—	—						
1ST	D	N	20'×9' = 180	6×6 = 36	—	36	144		N	4×6 = 24	20'×17½'×9' = 3150	—	20'×17½' = 350
		E	17½'×9' = 158	6×6 = 36	—	36	122		–	—			
		S	18'×9' = 162	—	—	—	162						
1ST	E	E	9½'×9' = 86	6×6 = 36	—	36	50		–	—	9½'×18'×9' = 1540	9½'×18' = 171	—
		–	—	—	—	—	—		–	—			
		–	—	—	—	—	—						
1ST	F	N	19½'×9' = 176	6×6 = 36	—	36	140		N	4×6 = 24	19½'×27'×9' = 4730	19½'×27' = 526	—
		W	27'×9' = 243	2(6×6) = 72	—	72	171		W	2(4×6) = 48			
		E	16'×9' = 144	—	—		144						
2ND	G	E	27'×9' = 243	2(6×6) = 72	—	72	171		–	—	27'×19'×9' = 4610	27'×19' = 512	27'×19' = 512
		S	19'×9' = 171	6×6 = 36	—	36	135		–	—			
		–	—	—	—	—	—						
2ND	H	W	13'×9' = 117	6×6 = 36	—	36	81		W	4×6 = 24	13'×19'×9' = 2230	13'×19' = 247	13'×19' = 247
		S	19'×9' = 171	6×6 = 36	—	36	135		–	—			
		–	—	—	—	—	—						
2ND	I	W	12'-9"×9' = 115	6×6 = 36	—	36	79		W	4×6 = 24	12'-9"×17'-6"×9' = 2010	12'-9"×17'-6" = 223	12'-9"×17'-6" = 223
		N	17'-6"×9' = 158	—	—	—	158		–	—			
		–	—	—	—	—	—						
2ND	J	W	13'×9' = 117	6×6 = 36	—	36	81		W	4×6 = 24	13'×17'-6"×9' = 2050	13'×17'-6" = 227	13'×17'-6" = 227
		S	17½'×9' = 158	—	—		158		–	—			
		N	17½'×9' = 158	—	—	—	158						
2ND	K	W	13'×9' = 117	6×6 = 36	—	36	81		W	4×6 = 24	13'×17-6×9' = 2050	—	13'×17'-6" = 227
		S	17½'×9 = 158	—	—	–	158		–	—			
		–	—	—	—	—	—						
2ND	L	N	38'×9' = 342	2(6×6) = 72	—	72	270		N	2(4×6) = 48	13'-6"×38'×9' = 4620 26'×18'×9' = 4200	13'-6"×38' = 512 26'×18' = 468	13'-6"×38' = 512 26'×18' = 468
		W	13½'×9' = 122	6×6 = 36	—	36	86		W	4×6 = 24	8820	980	980
		E	39'×9' = 351	3(6×6) = 108	—	108	243						

A.M. DANIELS CO., CONSULTING ENGINEERS, WASH. D.C. SLIDE RULE COMPUTATIONS

The heat loss computations are now completed and systematically recorded on one sheet. They may readily be checked. The values in the last column form the basis for establishing the radiating areas.

Since there will be several different temperature ranges, if the student is not familiar with the determination of the proper radiator coefficient he should review Lesson 2 of Part 1 where the subject is covered in detail.

The following data are needed:

Heating medium, vapor.

Temperature of steam vapor (assumed at atmospheric temperature) = 212° F.

Still air at 70° F.

Radiators,—26-in. 4-col. (5 sq. ft. per section).

Radiator coefficient (Table R-2-1) = 1.55.

Radiation emission for the different rooms is tabulated by steps in Table S-8-3, Columns 1 to 7 inclusive. The values in Column 8 are obtained

TABLE S-8-2. HEAT LOSS CALCULATIONS FOR OFFICE BUILDING

HEAT LOSS CALCULATIONS — B.T.U. METHOD

FLOOR	ROOM DESIGNATION	WALL	WALL: TRANSMISSION FACTOR PER 1°F = 0.18 0.50 NET SQ.FT.	WALL: COEF.	WALL: B.T.U.	GLASS: TRANSMISSION FACTOR PER 1°F = 1.10 NET SQ.FT.	GLASS: COEF.	GLASS: B.T.U.	DOOR: TRANSMISSION FACTOR PER 1°F = 0.42 NET SQ.FT.	DOOR: COEF.	DOOR: B.T.U.	B.T.U. LOSS WALL GLASS DOOR COL. 6+9+12	EXPOSURE FACTOR	B.T.U. LOSS WALL GLASS DOOR INCLUDE EXPOSURE	INFILTRATION 0.028 ; 0.12 B.T.U. PER FT. CRACK P. 1° P. HOUR P. MILE VEL. LIN. FT.	INFILTRATION: COEF.	INFILTRATION: B.T.U.	CEILING TRANSMISSION FACTOR PER 1°F = 0.36 NET SQ.FT.	CEILING: COEF.	CEILING: B.T.U.	FLOOR TRANSMISSION FACTOR PER 1°F = 0.36 NET SQ.FT.	FLOOR: COEF.	FLOOR: B.T.U.	TOTAL B.T.U. LOSS COLS. 15 + 18 + 21 + 24
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1ST	A 80°	W	171	14.4	2460	72	88	6320	—	—	—	8780	1.25	10750	48	45	2160							
		E	171	14.4	2460	72	88	6320	—	—	—	8780	1.10	9640	—	—	—	—	—	—	1050	10.8	11350	44220
		S	279	14.4	4000	72	88	6320	—	—	—	10320	1.00	10320	—	—	—							
1ST	B 70°	W	72	12.6	868	—	—	—	45	29.4	1320	2188	1.20	2625	27	39	1060							
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	286	3.6	1030	286	7.2	2050	6765
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
1ST	C 70°	E	81	12.6	977	36	77	2770	—	—	—	3747	1.10	4119	—	—	—							
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	169	7.2	1220	5339
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
1ST	D 50°	N	144	9.0	1296	36	55	1980	—	—	—	3276	1.25	4095	24	29	698							
		E	122	9.0	1098	36	55	1980	—	—	—	3078	1.10	3386	—	—	—	350	3.6	-1260	—	—	—	5299
		S	162	10.	-1620	—	—	—	—	—	—	-1620	1.00	-1620	—	—	—							
1ST	E 70°	E	50	12.6	603	36	77	2770	—	—	—	3373	1.10	3710	—	—	—							
		N	162	10.	-1620	—	—	—	—	—	—	-1620	1.00	-1620	—	—	—	—	—	—	171	7.2	1230	3320
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
1ST	F 70°	N	140	12.6	1688	36	77	2770	—	—	—	4458	1.25	5573	24	39	930							
		W	171	12.6	2062	72	77	5544	—	—	—	7606	1.20	9125	48	39	1860	—	—	—	526	7.2	3780	22708
		E	144	10.	1440	—	—	—	—	—	—	1440	1.00	1440	—	—	—							
2ND	G 70°	E	171	12.6	2060	72	77	5540	—	—	—	7600	1.10	8360	—	—	—							
		S	135	12.6	1628	36	77	2770	—	—	—	4398	1.00	4398	—	—	—	512	10.8	5530	512	3.6	-1840	16448
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
2ND	H 70°	W	81	12.6	977	36	77	2770	—	—	—	3747	1.20	4496	24	39	930							
		S	135	12.6	1628	36	77	2770	—	—	—	4398	1.00	4398	—	—	—	247	10.8	2660	247	3.6	-885	10669
		—	—	—	—	—	—		—		—	—	—	—	—	—	—							
2ND	I 70°	W	79	12.6	953	36	77	2770	—	—	—	3723	1.20	4467	24	39	930							
		N	158	10.	1580	—	—	—	—	—	—	1580	1.00	1580	—	—	—	223	10.8	2410	223	3.6	-802	8585
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
2ND	J 60°	W	81	10.8	875	36	66	2370	—	—	—	3245	1.20	3894	24	35	840							
		N	158	10.	-1580	—	—	—	—	—	—	-1580	1.00	-1580	—	—	—	227	7.2	1620	227	3.6	-815	2379
		S	158	10.	-1580	—	—	—	—	—	—	-1580	1.00	-1580	—	—	—							
2ND	K 70°	W	81	12.6	977	36	77	2770	—	—	—	3747	1.20	4496	24	39	930							
		S	158	10.	1580	—	—	—	—	—	—	1580	1.00	1580	—	—	—	227	10.8	2450	—	—	—	9456
		—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—							
2ND	L 70°	N	270	12.6	3256	72	77	5540	—	—	—	8796	1.25	10996	48	39	1860							
		W	86	12.6	1037	36	77	2770	—	—	—	3807	1.20	4568	24	39	930	980	10.8	10600	350	7.2	2520	43824
		E	243	12.6	2930	108	77	8300	—	—	—	11230	1.10	12350	—	—	—							

A.M. DANIELS, CO. CONSULTING ENGINEERS, WASH. D.C. SLIDE RULE CALCULATIONS

TABLE S-8-3.—RADIATION REQUIREMENTS

Room	Room Air Temp., deg. F.	Temp. Heating Medium, deg. F.	Temp. Range, deg. F.	Diff. above or below Standard (150°) deg. F.	Radiator Co-efficient	Radiation Emission B.T.U. per hour per sq. ft.	B.T.U. Loss per Hour	Area Radiation Surface Required, Sq. ft.	Radiators Selected			Radiator Stub Spacing, In.
									No. Rad.	No. Sec.	Actual Surface, Sq. ft.	
1	2	3	4	5	6	7	8	9	10	11	12	13
A	80	212	132	–18	1.55	198	44220	222	4	12	240	37
B	70	212	142	–8	1.55	216	6765	31	1	7	35	22
C	70	212	142	–8	1.55	216	5339	25	1	5	25	16
D	50	212	162	+12	1.55	257	5299	21	1	5	25	16
E	70	212	142	–8	1.55	216	3320	15	1	3	15	10
F	70	212	142	–8	1.55	216	22708	105	2	11	110	34
G	70	212	142	–8	1.55	216	16448	76	2	8	80	25
H	70	212	142	–8	1.55	216	10669	50	1	10	50	31
I	70	212	142	–8	1.55	216	8585	40	1	8	40	25
J	60	212	152	+2	1.55	237	2379	10	1	3	15	10
K	70	212	142	–8	1.55	216	9456	44	1	9	45	28
									3	11	165	34
L	70	212	142	–8	1.55	216	43824	200	1	9	45	28
Total							179012		20		890	

from Table S-8-2, Column 25. Simple division of the value in Column 8 by value in Column 7 shows the square feet of radiating surface required for each of the rooms. Reference to Table R-1-1 permits selection of proper size radiators as noted in Columns 10, 11, and 12. The last column contains the radiator stub spacing.

Work Problem S-8-9

The radiators should next be located on the floor plans as shown in Fig. S-8-6. They should preferably be drawn to scale and described with appropriate simple notes as indicated.

With the foregoing material at hand, the basement plan (see Fig. S-8-7) may now be prepared. The boiler should be blocked in at the proper loca-

(*Continued on Page* 84)

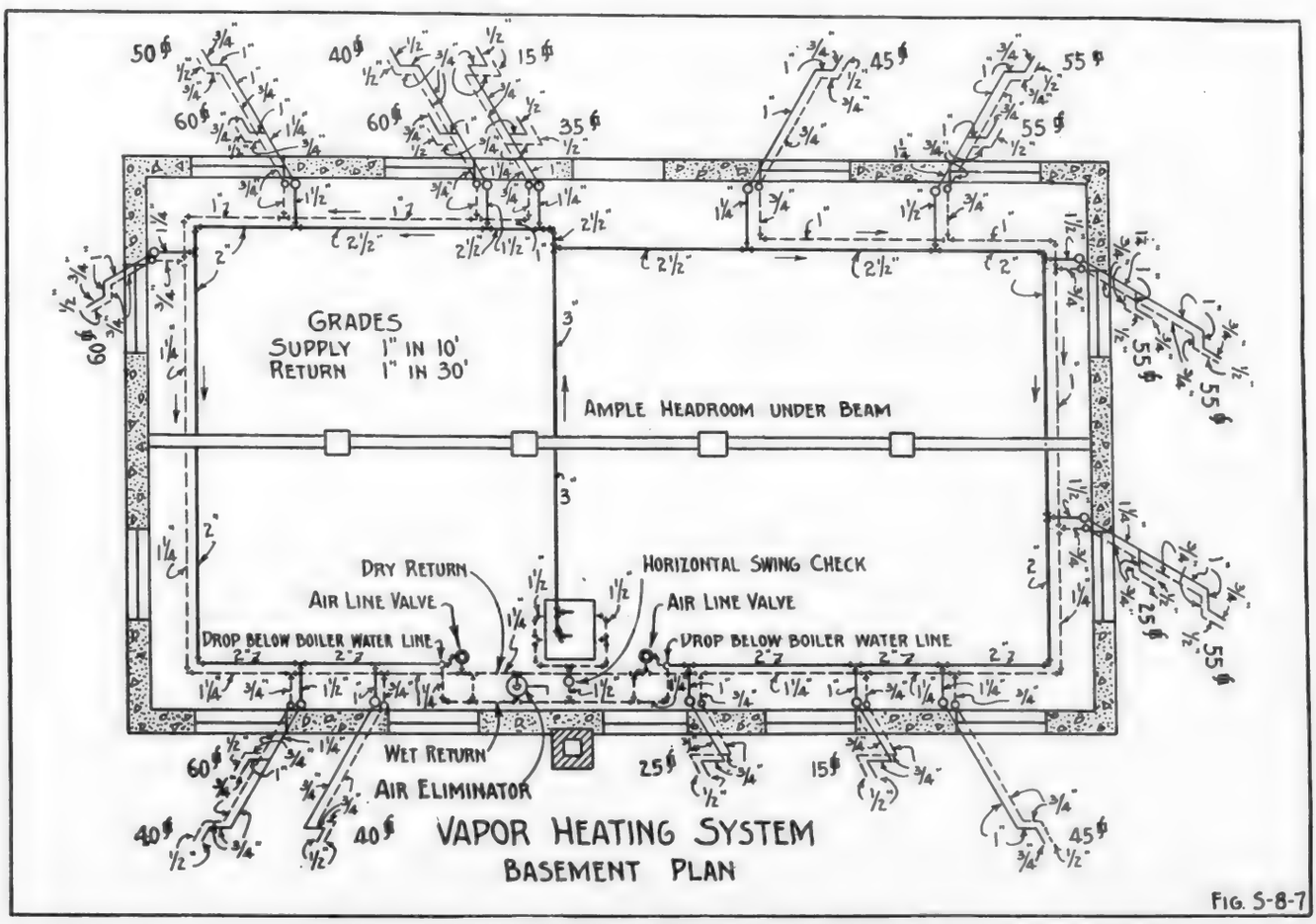


Fig. S-8-7. Basement Heating Plan for Vapor Heating System

Roosevelt Swimming Pool in Which 750 Pupils Take Swimming Lessons Every Week. This Pool is Emptied at Intervals of More Than two Months

The Mechanical Ventilation of the St. Louis Schools

AN ENGINEERING STUDY

By Edwin S. Hallett
Chief Engineer, St. Louis Board of Education

Part V

THE method of handling the ventilation of the various special rooms of a school call for much study and care to secure results equal to those of the main schoolrooms. The toilet rooms seem to have troubled a lot of people and it is here proposed to clear up the matter for them.

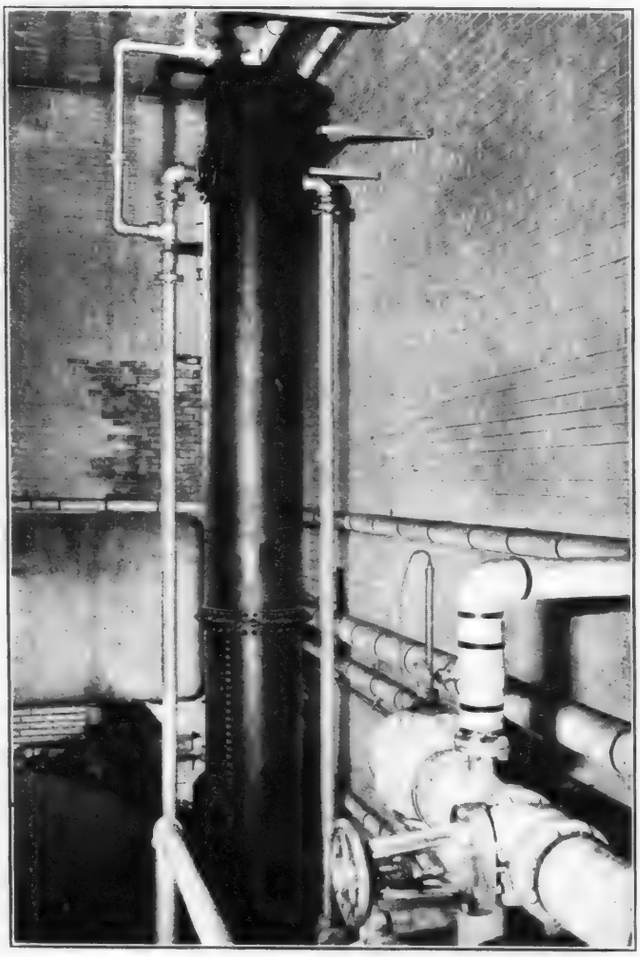
THE TOILET VENTILATION

All toilet rooms must have some air flow inward through the corridor doorway at all times. No air duct from a fan should ever be run to a toilet room as that would produce a pressure in the room and the flow would be outward into the corridor. An exhaust fan with an outlet duct should be installed in every school toilet. One fan may be connected by branches to several toilets, but the exhaust fan is the only satisfactory means of keeping the air traveling inward at the door. No attempt should be made to keep odors out of a toilet room by ventilation or other means. The proper thing to do is to keep the air always going inward and this will prevent any annoyance to the school.

Local inlets must be provided for fixtures, and to run metal ducts to each would be unsightly and subject to destruction. The St. Louis method is to leave an air space between the enameled face brick wall and the back building wall, and place a small 6-in. x 6-in. grill 6-in. from the floor adjacent to each closet. The hollow-wall air space is then connected to an exhaust duct of the toilet system. The boys' urinals are built in at the floor line and a duct connected to this so that an air flow is always down through the gutter. The fan is generally of the disc or propeller-type with about a half H.P. motor attached and placed in the attic. This motor is controlled from the engine room, and a red light signal is provided to indicate that the fan is running. The fan is purposely made small so that the exhaust shall be kept down to the actual amount necessary to keep air circulation through the toilets. This should be the principal air loss in the building.

In most buildings it will not be necessary to operate the exhaust fan while the main heating fan is running. It will be necessary, however, at all times while the ventilating fan is not in use. None of the substitutes for the exhaust are to be tolerated. The gas-burner in an exhaust stack has been tried and gives constant complaint, and likewise grates for coal fires and ventilator cowls have been tried and are not worth their cost.

The heat for the toilet rooms is best supplied by direct radiation, placed high near the ceiling, for two reasons: Nothing should be placed in reach



The Stand Pipe for Mixing the Ozone With the Water in the St. Louis Swimming Pool System of Purification

of pupils, and this radiation should be high enough to drain by gravity back to the boilers, without traps and pumps, in order to utilize the residual heat of the boiler at the close of school, and for convenience in heating on Saturday and Sunday in cold weather. Positive acting thermostats are placed on these ceiling radiators. The low efficiency of these ceiling radiators is justified by the other considerations. The piping is so graded that the building may be closed in cold weather, without bursting pipes, by siphoning the toilets or preferably by adding salt. This is occasionally necessary at the week end.

THE HYGIENE DEPARTMENT SUITE

All the St. Louis grade school buildings are now constructed with two rooms especially equipped for the examination of children by the nurse and physician. These rooms have the same ventilation as schoolrooms and, in addition, floor type of direct radiation with hand control. The nurse may want extra heat for a chilled or ill child and she may have it at will. Foot warmers are provided in the first corridors in all grade schools by emitting warm air from the front of long seats. Likewise a radiator is placed in each entrance as a cheerful welcome to every pupil. This radiator is always hot.

The grade schools all provide a room especially furnished and heated and lighted for the Patrons Society and other Community meetings. These rooms are ventilated and treated exactly like classrooms and, in addition, have direct radiation mounted high enough to drain to the boiler, as stated of the toilet rooms. These meetings could be held without the custodian being present as the reserve of steam will keep the radiators warm several hours after school closes. The rooms are locked off from the school. The schools and playgrounds are made to serve the local community in the best possible way.

GYMNASIUM AND DRESSING ROOMS

The most necessary and the most difficult ventilation is that of the gymnasium and the dressing rooms of a high school. The violent exercise produces body odors that must be removed by fan ventilation, yet the usual air motion is sufficient to produce discomfort in a few moments of rest. The best solution of this situation is the introduction of ozonized air in considerable quantity, but admitted with a diffuser that will not strike the performers who are undressed. The writer has installed special ventilation for hand-ball courts that the ordinary gym ventilation could not satisfy. This was done by a blow downward at the position of the players with a higher concentration of ozone. It produced the best results ever achieved. The temperature of a gym should be controlled down to 65 degrees while active exercise is on, and higher for quiet exercises, if there be such. The dual thermostat is suitable for this control. The open window produces a stratum of cold air on the floor only, and no air circulation is possible within.

Dressing rooms should have full ventilation equipment with a hand control for closing while changing clothing and taking the shower bath, and opened full between classes to sweep out the perspiration and soiled clothes odor. All gym suits should be removed from the dressing rooms at once, and washed and dried as soon as possible in a laundry for that purpose, owned and operated by the school. It is just as important as the apparatus.

Wherever a skylight monitor is built in the roof, as is done in St. Louis, heating coils must be installed under the glass to prevent cold-air drop from radiation.

SWIMMING POOLS

Greater interest has been shown in the whole scheme of swimming pools than in any other equipment, and it is proposed to give such definite descriptions as to aid the school or club in better pool construction. Unless a swimming pool is exactly right, it is repulsive and dangerous. The emptying of the pool every three days, or at any other interval, leaves the water unfit for all that time after the first class has had a plunge. It is impossible to have a fit pool at any time by a system of emptying and refilling. The process of

purification must be as continuous as the source of pollution. A test taken at any time must show as low bacteria count as the drinking water in the city mains. In fact, in practice, those of St. Louis are lower both in bacteria and other substances of animal and vegetable origin.

SWIMMING POOL EQUIPMENT

The layout of the pool and the engine-room equipment is very important and requires most careful consideration. Many pools are failures because of the lack of it. The pool should be located high enough that the bottom may drain by gravity to the circulating pump, and should be drained to the sewer at this point. The St. Louis pools in the last three high schools are approximately 25 ft. by 60 ft. and 8 ft. deep at the outlet, and hold nearly 60,000 gal. of water.

A centrifugal pump of the capacity of 5000 gal. per hour takes water from the bottom near one end and passes it through a sand filter, thence through the ozone stand pipe from which it flows by gravity back to the opposite end of the pool and falls in with a cascade effect. A special reheater is provided near the filter in the return line which has a regulator that maintains a temperature of 80 degrees in the pool. This heater passes the whole 5,000 gal. per hour, but raises the temperature a few degrees to hold a uniform temperature in the pool. In filling fresh water it is heated through the domestic storage heater through the night, but this occurs only at intervals of two months for the purpose of removing some stain from the tile lining of the pool. The make-up water for the maintenance of the pool level and for overflow skimming is supplied by waste water used in cooling the refrigerating condensers, and is as warm as the pool. This saves both water and heat.

PURIFICATION SYSTEMS

Ozone is the best medium of water purification for these pools. This is entirely distinct and different from the ozone for ventilation. For this purpose the ozone is generated and used in high concentration and is self regulating as any excess escapes at the top of the mixing stand-pipe. The water-cooled surface-discharge ozone producer is used for this purpose, and is admirably adapted to it.

The circulating pump is located preferably in the pump room as low as the bottom of the pool, and discharges the water under about 40 pounds through a sand filter, and thence in the ejector of the ozone stand-pipe.

This ejector draws the ozone from the generator and mixes the gas with the water, and the mixture rises 20 ft. to an overflow, whence the mixture flows by gravity back to the pool and enters above the water line at the end opposite the bottom outlet. This thoroughly incorporates ozone in the water to saturation. A faint odor of ozone can generally be detected at the infall of the water. It gives a slight bluish color to the pool. Some bubbles accumulate on the surface of the pool when not used for some time.

The action of ozone in purification of the water is the oxidation and destruction of at least all the pathogenic bacteria as reported by the Chicago Health Department test for that purpose, and, in addition, reduces to inert forms the organic matter entering this pool. It leaves no residue or by-product, and in fact leaves the water in the pool in a purer condition at all times than that of the city supply.

After constant use for nine weeks without emptying, and after use by 750 persons per week or a total of 6750 persons, the water was as good as at the first day. This is a condition that must exist. A pool must not show a deterioration at any time.

Liquid chlorine is unfit for this kind of purification. Chlorine acts by attacking substances in the water and thereby liberating oxygen in the nascent or active form, and this oxygen sterilizes the bacteria. But the unused chlorine and the chlorides produced are injurious agencies left in the water. They are irritating and damaging to delicate

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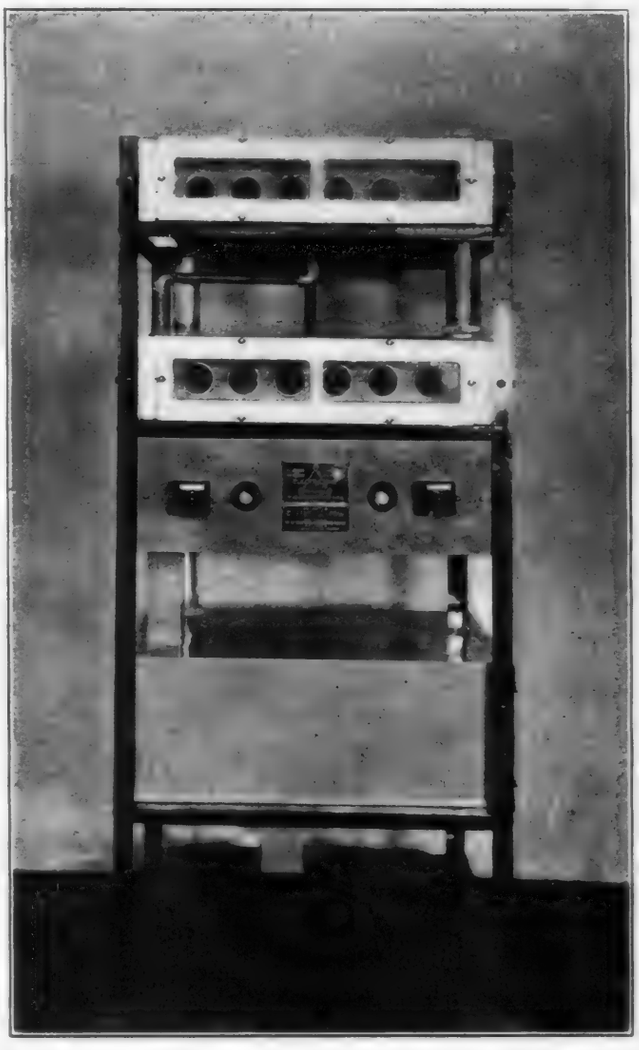


The High-Concentration Ozone Generator Used in Water Purification in the St. Louis Swimming Pools—Capacity 5000 Gallons Per Hour

Again—Recycling in the Oil-Burner Industry

ABOUT two months ago it casually was learned that a bright young oil-burner engineer, a resident of New York, had caused a "pipe-dream" of his to become an actuality. The story he told caused preparations to be made to present his accomplishments to the readers of THE HEATING AND VENTILATING MAGAZINE under the title of "A Pipe-Dream Comes True."

This engineer had worked out a scheme whereby all, or practically all, of the homes in a community were to be piped up to a central oil-supply station, and each home equipped with an oil burner. If this wild scheme could be accomplished, it would mean that oil could be delivered to any home, at any time during the winter, irrespective of weather conditions, and in this respect, at least, remove one of the factors favoring the use of gas for house heating.

JUST a year ago there was published in THE HEATING AND VENTILATING MAGAZINE, *a vital, human-interest story by M. A. Fesler, one of the real pioneers in the oil-burner industry. This story, predicated upon more than two decades of experience in designing and building oil burners, recounted many instances of things being done today that were developed, tried out and passed over in the early days of the industry. A rather apt title, "Recycling in the Oil-Burner Industry," was used for this story, and it is amazing how many times ad interim examples of "recycling" have been brought to light. The story here presented is a most interesting and forceful citation of this sort of thing.*

There is not the slightest doubt that the New York engineer referred to was entirely unaware of the Western forerunner of his scheme, and thought that he had developed something entirely new.

A fortunate contact with a nationally known real-estate developer literally made this "pipe-dream" come true, as the plan has been adopted and will be put into operation in one of the largest and most exclusive real-estate developments ever carried out in America. Preparations were made to secure the necessary photographs of tank and pipe installation, showing the scheme not as a "pipe-dream" but as a reality. Then came the shock.

In a letter received from a west-coast oil-burner manufacturer, containing data for the new edition of *"House Heating With Oil Fuel,"* there was casually mentioned an installation in California incorporating almost all of the essential details of the scheme referred to, and *this installation has been in continuous operation every day of every heating season for fifteen years.*

Now, through the courtesy of Mr. O. W. Degen, engineer in charge of War Department business, located at Fort Mason, San Francisco, THE HEATING AND VENTILATING MAGAZINE is enabled to present one of the most interesting stories that has yet come to light touching the oil-burner industry.

Fort Baker, Calif., is one of the guardians of the entrance to San Francisco Bay, and consists of the usual homes for officers, barracks and main buildings for enlisted men and supplementary buildings. These buildings are disposed approximately in the arc of a circle nearly three-quarters of a mile from tip to tip. In these buildings were installed 37 "gun" type burners, supplying heat to boilers, warm-air furnaces, hot-water heaters, bake ovens and ranges, throughout the post. One of the novel

(Left) Building 100,000 Gallon Oil-Storage Reservoir at Fort Baker, Calif.
(Right) The Completed Reservoir Being Filled by Tank Steamer Laying at Dock

features of the installation is that there are no blowers or equivalent equipment in any one of the buildings. In these burners the oil is atomized under air pressure but the distinctive feature is that the air is piped to each burner, being compressed in a central station.

Oil is delivered by tank steamer and pumped through a 6 in. pipe to a storage reservoir having a capacity of 100,000 gal., located on a hill at an elevation of 100 ft. above tide-water, this being the limit to which oil can be delivered by the steamer. From this reservoir, the oil is pumped, as required, into a distributing reservoir of 10,000 gal. capacity, built of reinforced concrete and located 100 ft. higher than the main storage. A 5 H.P. electric motor and triplex pump accomplishes this transfer. From this service tank, oil is distributed by gravity through 4-in. wrought-steel pipes throughout the entire reservation. Branches to houses are 2-in. wrought-steel pipe.

Naturally, great care was required in construct-

A Typical Oil-Fired Warm-Air Furnace in Officers' Quarters, Fort Baker, Calif. This Installation Has Been in Service for Fifteen Heating Seasons

ing this oil distributing system to prevent leakage. Expansion and contraction of the pipe was provided for by inserting U-bends every 300 ft., bedded in sand. The oil-distribution system is controlled by gate valves so that any desired section can be shut off without interfering with the rest.

The main reservoir is constructed on bed-rock, lined with 5-in. of concrete on the side, with metal reinforcing. The interior was sprayed with a cement gun.

Compressed air for all the burners is produced in a central station where two centrifugal air-compressors, each with a capacity of 750 cu. ft. of free air per minute under about 2 lbs. pressure, are driven by 10 H.P. A.C. motors. From this central station air pipe-lines, starting with 8-in. and reduced consecutively to 6-in., 5-in., 4-in. and 2½-in., follow the oil line to each building. The air and oil lines are extended into the basement with gate valves outside of each building. An oil pressure-regulating valve maintains a fixed pressure of about 30 lbs. at each burner. Each burner

Partial View of Three-Quarter Mile Line of Officers' Quarters, Barracks and Other Buildings, Fort Baker, Calif., Supplied from Single Oil-Storage Reservoir

is also provided with an oil meter with strainer and by-path.

Naturally, these burners were of the continuous-operation type, and provisions were made whereby the oil supply automatically is cut off in case of failure of air supply. In these days of complicated safety devices it is indeed interesting to look back on this fifteen-year-old installation and note the extraordinarily simple arrangement to provide against the combustion of oil outside of the combustion chamber. A low concrete rim was built to enclose a space in front of the ash-pit door of each boiler and around the periphery of this was placed a cotton string, the burning of which would release a weight, instantly shutting off the air and oil supply.

It is a pretty safe gamble that such a device would not have the ghost of a show in the Underwriters' Laboratory today, yet, fifteen years of use in 37 installations has proved its effectiveness.

For fifteen years these burners have been

Motor-Driven Air-Compressors in Central Station, Fort Baker, Calif.

handled by one man, ordinarily a sergeant in army rank, whose duty it is to make regular inspection of each oil-burning heating plant, to look after the oil-burning equipment generally, and to start the burners when required. This man also has charge of other electrical equipment at the post. It is but natural that such equipment should be maintained according to army standards, and an inspection made today of this fifteen year-old plant shows all of the brass parts of the burners polished and all pipe works neatly painted.

In a report made in November, 1913, Mr. Degen states that the total cost of oil heat for the month of October showed a saving of about 76% over the coal used in corresponding periods during previous years. At that time the burners were using California crude fuel-oil, about 15° A.P.I. gravity.

Conforming to conventional army practice, a careful record has been kept of all repairs and replacements made on this plant since its installation, and the figures here presented appear to be irrefutable evidence of the longevity of high-class oil-burner equipment *properly installed and properly taken care of.* Government records show that since the installation of these burners, the average annual cost for repairs has been less than $25.00 *for the entire installation.* These repairs consisted of extra burner nozzles, fire-bricks and refractory lining. There has been no replacement of motors or blowers during the entire period, and it is stated that the installation has not been out of commission a single day since it was installed.

The Mechanical Ventilation of the St. Louis Schools

(*Continued from Page* 81)

tissues. Ozone acts as active oxygen alone and leaves no by-products that can attack the skin.

The use of the violet ray is a variation of the ozone system except that the violet ray lamp is submerged in the water stream and the ray is affected by the glass and the turbidity of the water. At best it is a very poor ozone generator, and it is the ozone action that is of value to the purification. The cost of ozone and violet ray systems is about the same, and the breakage of violet ray lamps makes that system more expensive to maintain. This assumes the same kind of filter and recirculation methods.

The development of a perfect method of swimming-pool purification control and an economical maintenance is encouraging the rapid increase of this delightful exercise. When such a pool is installed, as is here described, the results of the test made by the city bacteriologist should be posted at a conspicuous place so that those who have hesitated on sanitary reasons may enjoy the sport and exercise in the security of a real ocean plunge.

New Home-Study Course in Gravity Steam and Water Heating

(*Continued from Page* 78)

tion and risers shown in correct positions by small circles. The piping run should then be studied and the best and most economical design established. No sizing of pipes should be made until the arrangement has been definitely decided.

Risers should then be laid down as indicated in Fig. S-8-7. Thus, all piping can be shown on this one plan. The areas of radiators supplied should be noted near the riser terminus.

Pipe sizes should be established for all parts of the risers first, before sizes for any of the branches or parts of the main are established. For a vapor system of this kind, the sizing of the main may begin at the last radiator served and progress towards the boiler.

The student should study this layout carefully, and after having assured himself that he is familiar with the design and details therefor, work the following problem.

Work Problem S-8-10

This concludes the part devoted to steam heating systems. The next part, to begin next month, will be devoted to boilers.

Etna Observatory Heated by Volcano

PROFESSOR Ponte, of the Etna Observatory, states that the recent reports published in America, about the utilization of the famous volcano for industrial purposes, were considerably exaggerated. According to the professor, the truth is that only a small quantity of the steam has been utilized for the heating of the observatory in winter. There is an escape of steam and gas, known as "fumarolo," some 300 yards from the observatory, which is active all the year round and from which water issues at a temperature of 160 deg. F. Two years ago a method was found for using this hot water by means of a pipe laid to the observatory.

Last year it was decided to capture the steam of the "fumarolo" in the same manner, and by means of a pipe conduit, to bring it to the observatory for heating purposes in winter. "There is no idea," Professor Ponte states, "of extending the use of the volcano's steam, as a sufficient supply is furnished by the 'fumarolo,' and by the time steam was conducted from a great distance it would have cooled and condensed." He is entirely satisfied with the fact that his observatory is comfortably heated in the winter.

Panel System Adopted in Solution of School Ventilation Problem

Scheme Proposed by One Contestant Involves Use of Radiant Heat Emitted from Flat Plates

ONE of the most original solutions of the problem in the School Ventilation Contest, conducted in THE HEATING AND VENTILATING MAGAZINE for December, 1926, arrived too late to receive consideration at the time the awards were made. This solution was submitted by F. S. Haddon, of Belfast, Ireland, and provides for a mechanical system using fans and ducts, the building being heated to about 65° F. by a system of "radiant heating."

The means for heating consists of large, flat cast-iron plates, 3/16 in. thick, through which a heating fluid or gas is circulated. Either water or low-pressure steam may be used for this purpose. A fan with a capacity of 17,000 C.F.M. is proposed and an air washer would also be employed. All fresh air is used for ventilating and no ozone is contemplated.

The basis of the ventilation requirements was taken by Mr. Haddon as 30 C.F.M. per pupil, and in assembly halls and other rooms, not regular classrooms, six air changes per hour were figured.

In answer to Question 20, Mr. Haddon briefly outlines this solution:

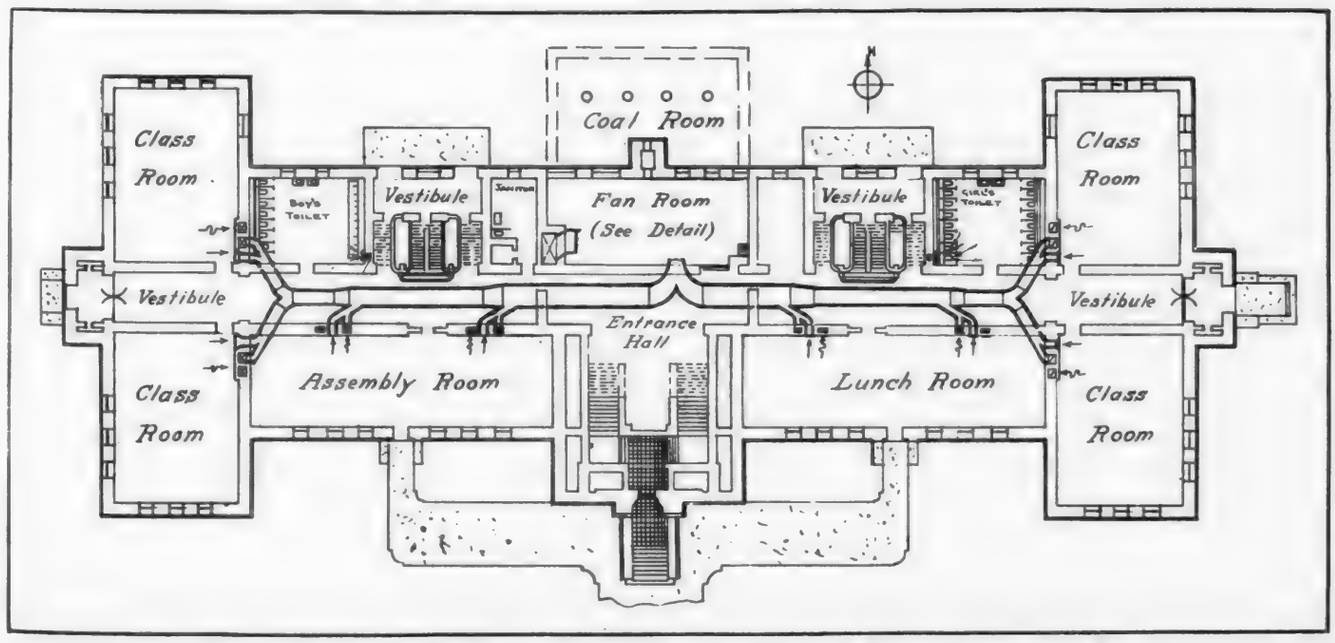
There are three essentials to be fulfilled for a school building of this type to be efficiently ventilated.

(1) The walls must be thoroughly warmed to a temperature at which it is required to keep the air, otherwise the body will lose heat by radiation to these cold surfaces.

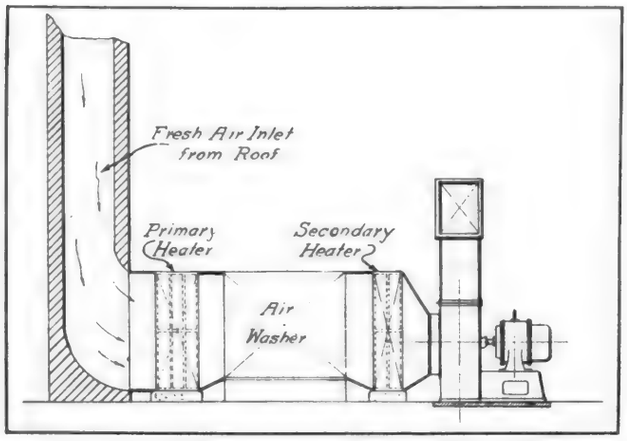
(2) An ample supply of fresh, pure air must be made to pass uniformly through the various rooms at a relatively low velocity.

(3) Heating of the air itself should be avoided as much as possible, and the body warmed by radiant heat. The temperature of the rooms must remain constant and the atmosphere kept within the "comfort zone," by insuring a sufficient moisture content of the air. A combined system of radiant heating and mechanical ventilation, supplying air at a low temperature, has been decided upon, as it is believed that the circulation of air is much better than when air at a high temperature is admitted to the rooms for heating purposes. The cooler air will descend more readily along the outer walls to the seating space where it is needed.

A mechanical system of ventilation has been chosen to insure a positive circulation of fresh air at the desired temperature and humidity, independent of atmospheric conditions. The difference in temperature between the outside air and that inside the building on warm spring days is too small to provide for the discharge of vitiated air and consequently, when good ventilation is most needed, there is little to be had. It should be re-



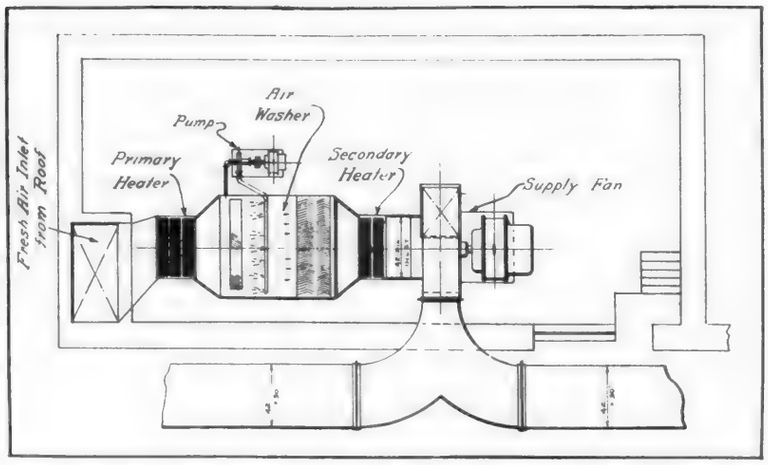
Mechanical School Air Conditioning System Submitted by F. S. Haddon of Belfast, Ireland



Elevation of School Air Conditioning Equipment Suggested by Mr. Haddon

membered that, more important than producing a certain condition or temperature in a room, is the effect such a condition has upon the occupants.

It is now generally accepted that radiant heat is more conducive to good health than heat carried by convection. Therefore a system which provides radiant heat is to be recommended, above warm convection currents, whether these be supplied by "direct radiators," so-called, or by hot air blown into the rooms. The radiant sections may vary in size from about 36 in. x 24 in. to about 10 ft. long x 24 in. wide, and are jointed together by right and left-hand nipples.



Plan of School Air Conditioning Equipment Showing Primary and Secondary Heaters, Air Washer and Motor-Driven Fan

When attached flat to the walls these sections are connected to the circulating pipes (usually ½ in. bore), and, although these panels may be kept at a much lower temperature than ordinary radiators, much better distribution of heat is obtained with a corresponding fuel saving, as the whole of the heat is used as radiant heat and is not wasted in heating the air of the room. In other words, the inside surface of the walls is kept at about 65° to 70° F., and consequently the room feels warm.

A. H. Barker states that "the amount of heating surface required in the radiant system is between one-half and two-thirds of that of ordinary radiators to produce equal heating effect, and the necessary fuel consumption is reduced in like proportion."

With such a system as the one here proposed the air is kept cool and fresh, and open windows with their consequent drafts are unnecessary.

The boiler plant is recommended to be fired by oil and, if this were done, the whole plant would be cool and clean, while the labor entailed in its operation would be pleasant and easy.

Wall Street Assay Office Picks Waste Gold Out of Air

AN ingenious system of mechanical air control and electrical precipitation, which reclaims gold from the atmosphere, has been worked out in the United States Assay Office, in New York, which stands almost opposite the New York Stock Exchange. Scientific tests have shown that the government is saving a substantial fortune each year by recovering gold that formerly went up the chimney in fumes and infinitesimal dust, besides eliminating a nuisance and menace to health.

The use of forced draft, dust collection, gas conveying, and other methods of air control by mechanical means, which is being widely urged as a cure for the smoke nuisance in American cities, played a big part in the final solution of the gold-saving problem of the Assay Office. A giant fan, capable of handling approximately 70,000 cu. ft. of gases per minute at 100° F., was installed to perform, like a powerful mechanical slave of a modern Aladdin, a diversity of functions.

High-pressured, forced draft drives pungent gases from the gold-smelting furnaces and acid hoods up the stack to "settling" chambers, where the gold is removed by a special electrical method before the residue fumes are driven out 300 ft. into the air. In addition to its furnace duties, however, the big fan drew gases out of the first-floor rooms and ventilated them by drawing in fresh, filtered air.

Mint officials declare that the value of net results are indicated by the fact that recoveries have averaged about 5,000 lbs. of dust from the fumes, assaying more than 600 oz. of pure gold, valued at over $12,400, in comparatively short periods. In addition to the big saving of wealth, the system is providing healthful conditions for scores of workers, who formerly were compelled to labor in high temperatures and air loaded with poisonous gases, Treasury officials assert.

Solving the Heating Problem with Steam Wells

IN THE HEATING AND VENTILATING MAGAZINE for November were presented two pictures of steam wells. More complete details of this novel scheme are now available, and it is learned that work is well under way on the project of harnessing these wells for power development purposes.

It is claimed that Healdsburg, Sonoma County, Cal., is the only place inhabited, in America, where heat is supplied by nature, free of charge. In this locality, at what is locally known as "The Geysers," are found numerous volcanic vents and fumaroles from which natural steam is continuously emitted.

The proposition has been attacked by driving a series of wells to a great pressure tank of this steam lying far below the surface, with the primary idea of rising this steam for the production power; it is reasonable to assume that if this proves feasible, its application to heating requirements will also naturally follow.

Depths to which the wells are driven vary from 200 ft. to 500 ft., and in well No. 5 a pressure of 276 lbs. gauge is recorded. Seven of the wells have a 10-in. outside wrought-steel casing with an 8-in. inside casing of the same material. The last well drilled has a 15-in. outside casing and a 12-in. inside casing.

The steam obtained from the wells has a general temperature corresponding to its pressure with some indications of superheat, and, for more than three years, the first two wells have given off enough steam to generate 500 H.P. without the slightest variation in pressure. Engineers in charge of the work believe that, from tests already carried out and geologists' reports, the entire valley, involving 2400 acres, can be pitted with steam wells, each well yielding steam of dependable pressure and in equal or greater amounts than the present wells.

CLOUDS OF VAPOR RISE 500 FT.

Noise caused by the escape of steam from the wells at such high pressure, can be heard for a distance of about four miles, and, when the special valves attached to the top of the casings to control the flow of steam are fully open, the clouds of vapor rise to a height of 500 ft. or over.

Tests of the steam which have been made show that the steam is over 98% pure steam, and a practical test of its use in practical operation has been made for some time, by running it directly to a small turbine, operating the generator supplying lighting current for the buildings and grounds at the "geysers." So far, the metal of the turbine shows no detrimental effects of any kind.

The method of well drilling consists of setting up a derrick about 60 ft. high over the spot desired, and the work is proceeded with similar to the method used in drilling for oil or gas. The drill is operated by an engine, which is supplied with steam from one of the nearby wells, and an open hole is drilled through the overburden and into the rock, as far as possible.

A wrought-steel casing is then set into this hole, and the space between the casing and the sides of the hole is poured full of cement grout, which is allowed to harden. The well is then continued deeper into the rock until a good flow of steam is obtained, at which time an inside casing is inserted and the space between the two casings is poured full of cement. This usually carries the well down about 200 ft., and below this level the well is drilled as an open well without casing.

As soon as the proper depth is reached, all openings in the well are closed and the drill removed.

Steam Geyser in Healdsburg, Calif., Harnessed to Supply Steam for Power and Heating

A small house is then built about 50 ft. away from the well for protection, and there is a general exodus of everyone in the vicinity to a safe distance. A single operator enters the small house devised to protect him from steam and hot water, and, by means of a long rod, extending from the house to the valve on the top of the well casing, opens the valve to blow out the hot water. The results are highly spectacular and not a little awe-inspiring.

STEAM VENTS DISCOVERED IN 1847

Although these steam vents were discovered by white men as far back as 1847, no effort to utilize their properties has been made until recently. The Indians knew of them and considered them the last creation of the Great Spirit, but when the first white man, by the name of William B. Elliott, stumbled on to them while trailing a wounded bear, he went back to his party with the report that he had found the gate to the infernal regions.

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

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RATE of development in an art or science logically may be taken as an index of public interest in that art or science. Given two or more industries of otherwise equal importance, that in which the faster progress is being made naturally demands and receives the greater portion of public interest.

This thesis explains, in a large measure, what has appeared to many to be an undue amount of editorial attention devoted to the oil-burner industry by THE HEATING AND VENTILATING MAGAZINE. Of two equally important and interesting articles given the same presentation on adjoining pages, the one dealing with oil burning probably will receive more attention since the subject is in the minds and mouths of magazine readers in their homes, clubs, commuting trains and even on the golf course.

The up-trend of the industry from an engineering point of view is clearly evident to anyone who has attended the last two exhibitions at the American Oil Burner Association conventions, and it is in the advance in oil-burner engineering that our readers are primarily interested.

The article "Some Thoughts on the Combustion of Oil Fuel," in this issue, is one of the magazine's contributions to the technology of the oil-burner industry, made with the feeling that a sound foundation is the best starting-point for rapid and sure development.

IT is a significant sign of the times that the thought of automatically supplied fuel and automatically initiated and controlled combustion is permeating the minds of all who deal with the heating of homes. In the past, thermostatic control of temperature has been common in factories, schools and commercial buildings where the fuel has been manually handled by firemen or janitors or mechanically fed by automatic stokers. The thermostatic control of temperature in the home has been possible over a long period but has never become a vogue. Now, because of the rapidly developing technique of the automatic supply, ignition, and control of fluid fuels, both oil and gas are beginning to cut heavily into the use of coal as a domestic fuel.

The coal advocates to-day are basing much of their sales talk on the ground that heat produced by coal can be controlled automatically, which, of course, is true. The largest factor, however, in the growing use of fluid fuel is *adaptability to automatic firing*, which, up to the present, has not been possible with coal. There is a general awakening of the customer public to the fact that automatically-produced and controlled combustion is an established accomplishment. Such operation in the home is being demanded to an increasing extent by the consumer and rapidly is becoming a dominant factor in the production, distribution and use of fluid fuels.

FROM its inception "certified heating" has had the support of THE HEATING AND VENTILATING MAGAZINE. Early in the progress of the movement we entered into an arrangement with the Heating and Piping Contractors National Association to publish as data sheets the Standard Radiation Estimating Tables which are part and parcel of the association's Engineering Standards on which "certified heating" is based.

It is not at all surprising that the industry has been slow to adopt "certified heating." Added to a natural inertia there have been many practical difficulties. For instance, one of the prime requisites is a strong local organization of heating contractors. It had to be learned, too, that "certified heating" is not a panacea for all ills. But now the industry is thoroughly aware of its opportunity and fast upon the appointment by the national association of a Certified Heating Committee comes the important announcement that, in addition to the eleven cities which have adopted "certified heating", no less than eight more are at work on plans to do likewise. As Chairman Snow stated, it is evident that "certified heating has passed the experimental stage and is now entering a period of national development." And, may we add, of national achievement.

What is the Boiler Overload When Starting Up a Heating System?

Some Enlightening Calculations Which Indicate a Far Lower Peak Than That Usually Estimated

By Harold L. Alt

DISCUSSION has arisen from time to time as to how much overload is thrown on a boiler when a heating system is being started up. No question seems ever to have been raised as to whether or not there really is any such overload, but, on the contrary, there has been a more or less tolerant attitude of mind which has accepted such assertions without protest or investigation.

For instance, a manufacturer of brass radiators says this overload on the boiler amounts to 150%; a prominent boiler manufacturer says it amounts to considerable and should be allowed for in sizing the boiler; the A.S.H. & V.E. has made radiator tests showing the condensation occurring in a radiator while heating up and these tests seem to lend color to this rather popular belief.

TYPICAL INSTALLATION ANALYZED

But how much of this idea is justified and how much overload is actually secured under practical operating conditions? It is the purpose of this discussion to assume an ordinary case and to analyze this in detail to determine of what the overload, if any, consists.

Suppose an ordinary steam heating system of, say, 3,000 sq. ft. of direct radiation be taken as representing the problem; for greater ease in discussing let it be assumed that this system consists of 60 radiators, of 50 sq. ft. each, so set along a single main that the distance from one radiator connection to the next is the same in each and every case. Also let the periods of time be divided into 15-minute intervals, the first 15 minutes being called "A", the second 15 minutes being called "B", and so on to the sixth 15-minute interval, which will come out as "F".

The next quantity to be determined is the amount of heat required to warm up the system from a temperature of about 50° F. to 220° F., or a rise of 170°. In considering this phase of the problem there is no need to consider the boiler metal or even the water contained in the boiler for the reason that both must be warmed by the fire and brought up to a steam-making temperature before any steam is made; and, as the boiler load is expressed in steam—either produced or required—this factor has no bearing on the matter of boiler load after steaming is really under way.

Therefore, by this reasoning, it is plain that the only additional load on the boiler while heating up is the heat required to warm the metal of the radiators and the piping. If this amount is figured, then a starting point for calculating has been obtained.

TOTAL HEAT REQUIRED

Normal cast-iron radiation weighs about 7 lbs. per cubic foot, so the weight of the metal in the radiators will be

(1) 3,000 × 7 lbs., or 21,000 lbs.

For the piping, fittings, valves, etc., a rough allowance can be taken of 25%; this will vary, of course, in every job, but the figure selected is considered a fair one and quite close enough for the purpose in view. Then the weight allowed for piping will be

(2) 21,000 × 25%, or 5,200 lbs.

So the total weight of metal to be warmed up by the boiler after it begins to steam is

(3) 21,000 + 5,200, or 26,200 lbs.

There is a little variation in the specific heat between cast-iron and wrought-iron, but 0.12 is a reasonably average figure. Using this factor, with a temperature rise of 170°, the total heat required for the metal is

(4) 26,200 × 0.12 × 170, or 534,480 B.T.U.

This gives a working basis by showing that during the heating-up period a total of 534,480 B. T. U. must be added to the other radiation given off in order to heat up the metal in the system. If this metal is heated up during a period of 45 minutes, then the B. T. U. per minute will average

(5) 534,480/45, or 11,878 B.T.U. per minute.

If, however, this heating-up period is extended to 75 minutes, then the B.T.U. per minute will be

(6) 534,480/75, or 7,125 B.T.U. per minute.

HEAT EMITTED BY RADIATORS AND PIPING

Now taking the normal radiation loss and assuming that the radiation has an average heat emission of 240 B.T.U. per square foot, the amount of heat emitted by the radiators when in full operation will be

(7) 3,000 × 240, or 720,000 B.T.U. per hour.

Losses in the piping will increase this about 25% so the pipe loss may be taken as

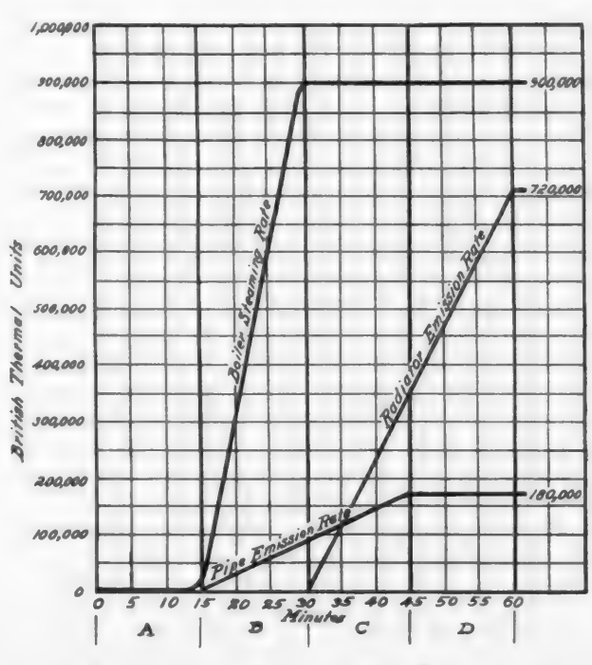

Fig. 1. Curves Showing Conditions During First Hour after Starting Fire

(8) 720,000 × 25%, or 180,000 B.T.U. per hour.

The sum of these two amounts represents the total heat emission from the system when in full operation which is

(9) 720,000 + 180,000 or 900,000 B.T.U. per hour.

SIZE OF BOILER NECESSARY

Then the boiler must supply, for a purely operating load, not less than 900,000 B.T.U. per hour just to get by. It is quite likely, on a job of this size, that any good engineer, or contractor, would recommend a boiler of at least 4,000 sq. ft. rating, which would make the boiler normal delivery, expressed in B.T.U., and without the least overloading,

(10) 4,000 × 240, or 960,000 B.T.U. per hour.

In order to show that no assumptions favorable to the boiler are being taken in the subsequent calculations, it will be assumed that the boiler installed will only produce just the bare 900,000 B.T.U. required for actual operation, without any consideration or allowance being made for heating up. In this case the B.T.U. production of the boiler per minute will be

(11) 900,000 /60, or 15,000 B.T.U. per minute.

HOW A SYSTEM HEATS UP

Here, a pause must be made and the way a common steam system heats up must be considered. While there is a great variation in various installations, there is a general tendency in all systems to have the steam start along the the steam main from the boiler, reaching the nearest radiators first and the farthest radiators last. This would be particularly true in the design herein assumed, viz., a single, continuous main, with radiators tapped off at stated and regular intervals.

In any well-designed heating system of moderate size, and starting with everything cold, the last radiator can usually be heated in from 60 to 90 minutes after lighting the fire. If the system under consideration can be heated in 60 minutes without overloading the boiler, it follows that the boiler must be able to supply the necessary B.T.U. to heat up the metal in the radiators and piping, which amounted to 534,480 B.T.U. (4), and also to supply the heat emission which will take place during the same period. This heat emission has not yet been calculated; only the heat emission for the entire system *after it has become fully heated* has been figured (9) so far.

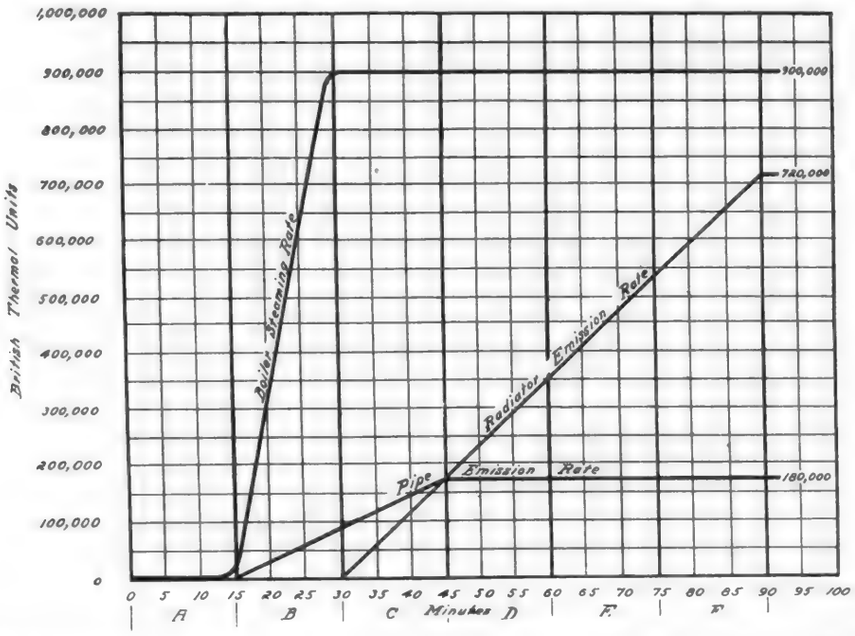

Fig. 2. Curves Showing Conditions During First Hour and a Half after Starting Fire

As previously mentioned, it is desirable to divide the time into intervals of a quarter hour each, calling the first quarter "A". No practical boiler man will dispute that during the first quarter hour, or in period "A," after lighting the fire, all the heat generated by the fire is passing into the boiler and the boiler water, being utilized in bringing them up to temperature.

In the second quarter hour, or period "B", the boiler begins steaming and, probably by the end of the second quarter—or 30 minutes after lighting the fire, the boiler is delivering its full normal amount of steam. This steam is passing out into the steam main and may even have heated the entire steam main.

At the beginning of the third 15-minute period, or "C" period, the radiators begin to show warm ends, the heating of the radiators continuing through this period and the next period, "D", until, at the close of period "D", all radiators are fully heated. Such is the approximate cycle of heating up when the system can be fully heated in the total time of 60 minutes.

HEAT EMITTED WHILE WARMING UP

Now just what does this mean as far as the matter of heat emission is concerned? Consider the radiators first. As they do not begin to heat until the beginning of period "C" there will be no heat emission at all from them during periods "A" and "B", but, during "C" and "D" they progress from an entirely cold condition to an entirely hot state, so it is logical to consider that at the end of period "C" they are about 50% heated and at the end of period "D" they are 100% heated. Since they progress from a cold state to a 50% heated condition during period "C", the average percentage hot during this period is

(12) $\frac{0\% \text{ plus } 50\%}{2} = 25\%$

and, as they progress from 50% to 100% during period "D" the average percentage heated during this later period is

(13) $\frac{50\% \text{ plus } 100\%}{2} = 75\%$

With this in mind the heat emission from the radiators (which is 12,000 B.T.U. per minute when operating fully heated) during the warming up time of 60 minutes, can be computed as follows:—

		B.T.U.
(14)	For "A" 12,000 × 15 min. × 0% or	00,000
	For "B" 12,000 × 15 min. × 0% or	00,000
	For "C" 12,000 × 15 min. × 25% or	45,000
	For "D" 12,000 × 15 min. × 75% or	135,000
(15)	Total radiator delivery	180,000

The 12,000 B.T.U. used above is obtained by dividing the total radiator emission for one hour (7) of 720,000 B.T.U. by 60 to get the radiator emission per minute.

PIPING LOSS WHILE HEATING UP

But the piping emission has still to be considered. With the piping the situation is somewhat different; the main begins to heat as soon as steam begins to form and to be delivered by the boiler. This commences at the beginning of period "B". Yet all of the piping is not usually hot until the end of period "C"; therefore it may be said that the heating up of the piping occurs during "B" and "C" periods.

With this premise it is reasonable to assert that the piping is 50% heated at the end of period "B" and 100% heated at the end of period "C". Then the average percentage of the piping hot during period "B" is

(16) $\frac{50\% \text{ plus } 0\%}{2} = 25\%$

and, similarly, the average percentage of piping hot during period "C" is

(17) $\frac{100\% \text{ plus } 50\%}{2} = 75\%$

while during period "D" the percentage is 100%.

If the total hourly emission of heat (8) from the piping is reduced to a minute basis the amount is

(18) 180,000/60, or 3,000 B.T.U. per minute.

and the heat emission for each period is

	B.T.U.
(19) For "A" 3,000 × 15 × 0% or	00,000
For "B" 3,000 × 15 × 25% or	11,250
For "C" 3,000 × 15 × 75% or	33,750
For "D" 3,000 × 15 × 100% or	45,000
(20) Total piping loss	90,000

TOTAL HEAT REQUIRED WHILE WARMING UP

The grand total of all the heat emitted by the entire heating system, including both piping and radiators, may now be ascertained by adding (15) and (20) together thus,

(21) 180,000 + 90,000, or 270,000 B.T.U.

This demonstrates that, if the heating system under consideration heated up in 60 minutes, it would be necessary to supply a total of the B.T.U. radiated (21) and the B.T.U. necessary for specific heat (4) or

(22) 270,000 + 534,480 or 804,480 B.T.U.

BOILER DELIVERY FOR FIRST 60 MINUTES

The boiler, without overload and with not the slightest surplus capacity, will deliver 900,000 B.T.U. per hour, which is considerably in excess of the necessary amount, but, unfortunately, the boiler is not delivering steam at full capacity during the whole 60-minute period. It has been assumed that the boiler commenced making steam at the end of period "A" and came up to its full delivery at the beginning of period "C".

With this assumption the steam delivery for period "B" would be about 50% and, for periods "C" and "D", fully 100%. The calculation of the boiler delivery for the whole 60-minute period is, then

	B.T.U.
(23) For "A" 15,000 × 15 × 0% or	000,000
For "B" 15,000 × 15 × 50% or	112,500
For "C" 15,000 × 15 × 100% or	225,000
For "D" 15,000 × 15 × 100% or	225,000
(24) Total B.T.U. produced during first 60 minutes	562,500

OVERLOAD FOR 60-MINUTE WARMING-UP PERIOD

As the total B.T.U. required to heat up this system in 60 minutes has already been found to be 804,480 B.T.U. in (22) the shortage in B.T.U. produced by the boiler during the same period and without overloading (24) is found to be

(25) 804,480—562,500 or 241,980 B.T.U.

This means that with this particular system, it would be impossible to warm up in 60 minutes without overloading the boiler to the extent of 241,980 B.T.U. If this amount is reduced to a minute basis, the B.T.U. overload per minute is

(26) 241,980/30, or 8,066 B.T.U. per minute.

This is because the boiler is actually producing steam during only 30 minutes of the first hour and, consequently, if an overload must be carried, it will have to be during the 30 minutes when the boiler is making steam. As the normal steaming rate of the boiler is such as to produce 15,000 B.T.U. per minute, the percentage of overload which must be carried is

(27) 8,066/15,000, or 54%.

As it has been assumed that the boiler under discussion will not carry the least particle of overload, it is quite plain that it would be impossible to heat up this system in the minimum time of 60 minutes. But what would happen if, say, 90 minutes were considered?

PERIOD OF 90 MINUTES CONSIDERED

By taking the same method of procedure as already used, but extending the time so as to allow an additional 30 minutes, it is found that the heat emission from the radiators previously given in (14) becomes

	B.T.U.
(28) For "A" 12,000 × 15 × 0% or	000,000
For "B" 12,000 × 15 × 0% or	000,000
For "C" 12,000 × 15 × 12½% or	22,500
For "D" 12,000 × 15 × 37½% or	67,500
For "E" 12,000 × 15 × 62½% or	112,500
For "F" 12,000 × 15 × 87½% or	157,500
(29) Total heat emitted by radiators	360,000

For the piping the loss up to the end of period "D", as shown in (20), or 90,000 B.T.U., must be increased for another 30 minutes which amounts to

(30) 90,000 + 3,000 × 30, or 180,000 B.T.U.

The total heat emitted by the system in warming up during 90 minutes will then be

(31) 360,000 + 180,000, or 540,000 B.T.U.

and, as the specific heat remains as before, the total which must be supplied by the boiler during the first 90 minutes will be

(32) 540,000 + 534,480, or 1,074,480 B.T.U.

Now the boiler at normal load has been shown to deliver 562,500 B.T.U. (24) up to the end of the first hour, and it is known that this is at the rate of 15,000 B.T.U. per minute, so that in another 30 minutes there will be an additional delivery of 450,000 B.T.U., making a total boiler delivery for the entire period of

(33) 562,000 + 450,000, or 1,012,000 B.T.U.

As this slightly exceeds the quantity demanded for all needs as shown in (32), this proves that the system could be heated up in a little less than 90 minutes *without any overload on the boiler whatsoever.*

Eight More Cities Taking up "Certified Heating"

An indication of the growing popularity of the "certified heating" movement is given in the statement of Chairman Herbert A. Snow, of the Committee on Certified Heating of the Heating and Piping Contractors National Association, issued at the close of a recent meeting of that committee, in New York, March 1 and 2. Those present, in addition to Chairman Snow, were Louis T. Braun, Chicago; William D. Emery, New York; Thomas Gale, St. Louis; E. M. Harrington, Detroit; and A. R. Herske, Cleveland.

Since the beginning of this work in Chicago, ten years ago, said Mr. Snow, many new ideas have been developed and a mass of information collected concerning the operation of the plan. "The committee feels," added Mr. Snow, "that certified heating has passed the experimental stage and is now entering a period of national development. The heating and piping contractors of eleven of the large cities have adopted this method of assuring the public that the heating plants they buy will give them comfort when winter comes.

"Eight other cities are at work on plans and the correspondence of national headquarters shows a widespread interest in every section of the country in this movement."

The committee has adopted a program for establishing certified heating and the distribution of this program has been authorized to any interested heating and piping contractor. Requests for this information should be addressed to Secretary Henry B. Gombers, Heating and Piping Contractors National Association, 50 Union Square, East, New York City.

ARC-WELDING is the title of a new book published by the Lincoln Electric Co., Cleveland, O. This is a very complete work on arc welding, as applied to various classes of work, containing chapters on the new age of steel, steel versus cast-iron, arc weldings make riveting obsolete, what arc welding is and what it does, other methods of welding, arc welding in general manufacturing, strength of arc-welded joints, speed and cost of welding and automatic arc welding. Bound with flexible cover. Size 6 x 9 in. Pp. 160. Price $1.50.

Heating and Ventilating Garages

By Walter Tusch
Tenney & Ohmes, New York.

(Reprinted, by special permission, from The Architectural Forum for March, 1927)

THE public garage in this climate (New York) must be heated, both for the protection of cars and the comfort of patrons. Sometimes the more simple the problem may appear to the layman, the more difficult it is in reality. The one almost insurmountable difficulty is to overcome the chilling effect produced by the opening of doors for the entrance and exit of cars. The best device for the purpose is probably a power-operated door, of the "jack-knife" type, hinged at the top and provided with a horizontal joint in its center, so that, when the door is fully open, the two parts rest at the ceiling practically in two parallel horizontal planes. In any event, the larger part of the heating equipment should be concentrated as near the doors as possible.

This leads to a second difficulty, which is to provide proper space for the radiation where it is most required. The radiators or coils should be located as near the floor as possible and yet sufficiently high to avoid being damaged by the impact of cars, and locations must be selected which will not sacrifice valuable floor area.

Column centers are usually selected to give maximum car space with minimum clearances, and little space can be spared for radiators. Ceiling heights are also worked out for minimum headroom, so that even overhead unit heaters entail a loss of valuable floor area. All rising lines of the piping system should also be located so as to be safe from possible car impact.

PROBLEM INVOLVES A BUILDING WITHOUT INTERIOR PARTITIONS

The heating designer must also bear in mind that a building without interior partitions and entirely undivided, as is the case in the garage, requires a greater expenditure of heat to produce satisfaction, especially on windy days. The reason for this is that cold air entering through leaky window construction, often found in garages, has a clear and unimpeded sweep across the entire floor to the leeward side of the building, where the warmer air is forced out through all openings. So it is a good investment to provide for calking airtight both inside and outside between window casings and masonry.

UPDRAFTS IN MULTI-STORIED GARAGES

The multi-storied garage brings to the fore, in an aggravated way, another factor which cannot be overlooked,—that is, "updraft." In every heated building the tendency of the warm interior air is to rise and escape through crevices, open windows or vents on the upper floors, to be replaced by cold exterior air entering through opened doors, crevices or windows in the lower stories. The taller the building and the more open its interior arrangement, the more marked is this effect.

Thus, a multi-storied garage, with its open floors and the usual ramps connecting its various levels, offers less resistance to this effect than practically any other type of building. Add to this the frequent opening of doors for the entrance and exit of cars and a careless or too liberal opening of windows and ventilating outlets on the upper floors, and the garage may become a veritable cave of the winds in it slower stories, and at the same time be greatly oversupplied with heating surface on the upper floors.

INDOOR TEMPERATURE REQUIREMENTS USUALLY 55° F.

In general the heating apparatus should be designed for 55° F temperature in zero weather, but very liberal allowances must be made for the main doors, and for ventilation, as hereafter mentioned. A large amount of heat is both radiated from entering cars and discharged from their exhausts, but this is such a variable quantity as to be undependable.

All departments other than space used distinctly for car storage, such as waiting and supply rooms, toilets, and store rooms included in the building, should be served by separate mains for purposes of economy, as they will require heat at times when it is not needed in the garage proper. Such rooms, of course, should be heated to 70°.

STEAM PREFERRED AS A HEATING MEDIUM

Generally speaking, steam is to be preferred as a heating medium, although hot water has certain advantages if freezing pipes and heating surfaces in exposed places are carefully guarded against. If steam can be secured from a steam service corporation at attractive rates, and if a timing control device is installed to automatically shut off the steam in accordance with the hour and the weather, it may be far cheaper to purchase all steam required.

The necessity of banking fires, and starting them up again as required by a change of weather is one of the disadvantages of the private boiler plant, which cannot as economically take care of fluctuations of load as can a corporation selling steam for both heating and power.

The designing engineer should carefully and conscientiously anaylze the relative cost of purchasing, versus generating steam, taking into account charges for cost of construction, of space for the plant, cost of plant, maintenance and depreciation, taxes and insurance, extra labor, cost of coal, and ash removal, and be guided by the result.

VENTILATION REQUIREMENTS AFFECTED BY MANY FACTORS

The limitations of this article preclude a discussion of the theoretical requirements for ventilation, and it is doubtful if they could be successfully applied to a problem of this sort. So many factors enter that no workable formula is possible. As many windows as possible are installed, as a usual thing. Even when closed, they afford a means through leakage for the ingress of a considerable amount of fresh air.

When fresh air is most required, that is when many cars are in motion and discharging the maximum amount of exhaust, the entrances and exit doors are also most open and are providing an excess of fresh air.

LARGE AIR FLUES AND EXHAUST OUTLETS FAVORED

Bearing in mind that traffic, which is the measure of ventilation requirement, is not occurring in all parts of the building at the same time, it is advisable to be very liberal with the areas of the flues and exhaust outlets, but to keep the capacity of the fan or fans at less than the flue capacity.

An attendant is usually stationed on each floor, so that with good management, transient cars arriving are parked on certain floors or in certain areas. The attendant should open the exhaust outlets during such times, keeping them closed when traffic is light. The through traffic on the ramps will not noticeably affect an idle floor, as the updraught will carry all exhaust gases to the upper floors, where the cars are being berthed, and where the exhaust outlets should be fully open. This arrangement of design effects the maximum economy of installation and operation, but the attendants must be trained to cooperate or failure will be the result.

FIGURES FOR A TYPICAL INSTALLATION

Without intending to define a standard, because the requirements of every building will vary with its type, a few figures for a successful installation might be given as an example.

Suppose the building is of five stories, exposed on all sides, on a plot 130 ft. by

180 ft. It is provided with a fan capable of exhausting 60,000 cu. ft. per minute. With various toilets and shops, rather intensively ventilated, this allows about 10,000 cu. ft. per floor of car storage, or two and one-half changes per hour. With half of the outlets closed this could be increased to practically five changes per hour, or once in 12 minutes for any selected floor. This active air change, of course, materially increases window leakage and chilling effect.

In this building about 3,000 sq. ft. of additional radiating surface was installed to take care of this loss of heat, although this additional surface will actually heat only about 12,500 cu. ft. of air from 0° to 65°.

LOCATION OF VENT OPENING

The location of the vent openings necessarily will be determined largely by the general arrangement of the floor plan. It usually will be impossible to run any horizontal ducts at the ceilings to secure the refinement of an even distribution of the exhaust, and the outlets usually will be located directly in the walls of the vent shaft or shafts leading immediately to the exhaust apparatus located in the roof house.

It is evidently advisable to locate the exhaust in the center of the floor plan, if the building has window exposure on all sides, or as remote from the windows as possible, where window exposure is lacking on one or more walls. For evident reasons, also, the exhaust should not be located too near the ramps, where the air is in most active circulation, but rather so as to remove the air at the point of greatest stagnation. Exhaust would also be desirable at gasoline-dispensing points throughout the garage.

Gas Bomb Tests of Holland Vehicular Tunnel

THE ventilating system of one section of the new Holland vehicular tunnel under the Hudson River was tested on March 15, under the direction of Ole Singstad, chief engineer. The tests were witnessed by members of the tunnel commission and invited guests. The entire ventilating system consists of 84 batteries of fans, half of which supply the tunnels with fresh air and the other half draw out the vitiated air.

Only two draft and two blower fans were used to demonstrate ventilation of 650 ft. of the tunnel. These fans, handling 200,000 cu. ft. of air per minute, force it from the intake, 65 ft. above the ground level, into the distributing chamber beneath the tunnel pavement, whence it escapes through vents 10 ft. apart at the side of the roadway into the tunnel.

In making pictures of the party, it was found that the dense smoke from the flashlight powder passed out the roof vent so quickly that no odor was apparent. After inspecting the fire and flushing hydrants placed at 240 ft. intervals, the niches for sand and chemical fire-fighting apparatus for subduing gasoline and oil fires and other provisions for safety, two bombs were set off, which, Mr. Singstad said, would emit gas and smoke in a volume equal to that from several hundred automobiles, or from a good-sized automobile fire. Very little of the smoke was carried into the faces of the spectators, most of it being immediately drawn to the roof and through the exhaust ducts. The air was completely cleared of smoke within a minute after the bombs had burned out. Additional bombs were placed in the air chambers beside the roadway and, as fast as the dense smoke poured into the tunnel, it was sucked out through the roof exhaust. Mr. Singstad explained to the party that 28 blowers and exhaust fans were always held in reserve against accidents, this being a 50% stand-by reserve. It was stated by E. M. Barradale, secretary of the New Jersey tunnel commission, that, within a month, examinations would be held for positions on the tunnel police force of 160 men. It is expected that another 150 operatives will be required to maintain the tunnel after it has been opened for traffic.

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Setting Off Smoke Bombs in First Official Test of Holland Vehicular Tunnel Ventilation System

©International Newsreel 1927

One of Four Ventilating Shafts of Holland Vehicular Tunnel Housing a Portion of the Ventilating Equipment

Conductivity Values for Insulex

In his paper on "Insulation of a Private House," presented at the recent annual meeting of the American Society of Heating and Ventilating Engineers, and published in abstract in THE HEATING AND VENTILATING MAGAZINE, for February, 1927, the author, Lee Nusbaum, presented a list of conductivity values for insulating materials. In this list the density of light-weight Insulex was given as 18.1 lbs. per cubic foot, and the conductivity as 0.564 B.T.U. per square foot per inch thickness per degree F. per hour. For the more dense Insulex the density was given as 29.4 lbs., and the conductivity as 0.9 B. T. U.

We are advised by the Universal Gypsum & Lime Company that, according to tests made by the U. S. Bureau of Standards and at the Armour Institute of Technology, in Chicago, the figures should be Insulex, light-weight density 8 lbs. per cubic foot; conductivity 0.35 B.T.U.

Insulex, more dense material—density 12 lbs. per cubic foot, conductivity 0.44 B.T.U.

These figures will be inserted in a revised printing of Mr. Nusbaum's paper.

Why Hot Water Freezes Quicker Than Cold Water

EVERY householder knows that his hot water pipes freeze quicker than his cold water pipes. But why? Seemingly, there should be no reason, as, in the ordinary home, the hot water and cold water pipes usually parallel each other, and therefore, both are exposed to the same external temperatures at all times.

Despite the common knowledge of this phenomenon, the first laboratory demonstration proving its occurrence was given recently at East Pittsburgh by Leon McCulloch, research engineer of the Westinghouse Electric & Mfg. Company.

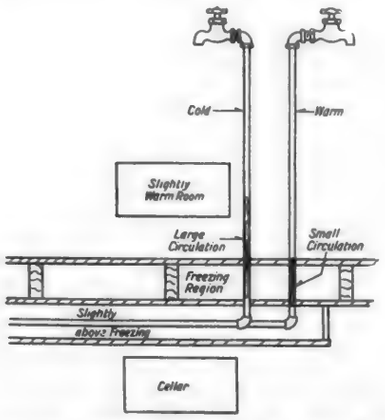
Mr. McCulloch states that he first heard of this peculiar behavior of the pipes fifteen years ago, but he believed that it could not be true. A few weeks ago, however, during freezing weather his own hot water pipe froze and in the process of thawing it out he sought to find a reason. He set up laboratory apparatus to find out whether or not a theory he had formed would stand the test of experiment. After two weeks of intermittent work, he convinced both himself and other workers that his theory could account for the more rapid freezing of the warm pipes.

His explanation is based upon the well-known fact that water is densest or heaviest a few degrees above freezing. On either side of this temperature, which is 39° F., the water is lighter. For example, at 44° F. one quart of water weighs 945 grams, at 39° F. it weighs 946 grams, while one quart of ice weighs only 887 grams.

MR. MC CULLOCH'S STATEMENT

A statement by Mr. McCulloch concerning his experimenting follows:

"Thus water changes in weight only about one part in 1,000 when its temperature drops from 39° to 32° F., but water is such a mobile fluid that this small decrease in density is enough to set up a circulation by convection when the lighter 32° water is at the bottom of a vessel and the heavier 39° water is at the top.



Typical Arrangement of Hot and Cold Water Service to a Sink or Other Fixture

Leon McCulloch Performing the Experiment Described on this Page

"If we have a tube or pipe containing water at its greatest density, 39° F., we can set up circulation and change the temperature of all the water in the tube, whether we apply heat to the bottom of the tube or whether we cool the bottom. For whether we heat or cool, we cause the bottom layers of the liquid to become lighter and to rise while the denser layers fall to the bottom where they, in turn, become either heated or cooled, as the case may be.

"Suppose we take a closed pipe filled with water and cool the lower end very slowly to the freezing temperature. As the water cools toward 39° it becomes denser and no circulation takes place until we cool below the 39° point. But when the water falls below this temperature it commences to become lighter than the layer of water at 39° which lies above it. This denser 39° water, therefore, starts to fall and the colder but lighter water rises out of the way. Thus a circulation is set up as the point of freezing is approached. This circulation, however, does not extend all the way up the tube but takes place only below that point in the pipe where the water is densest, which is where the temperature is about 39° F.

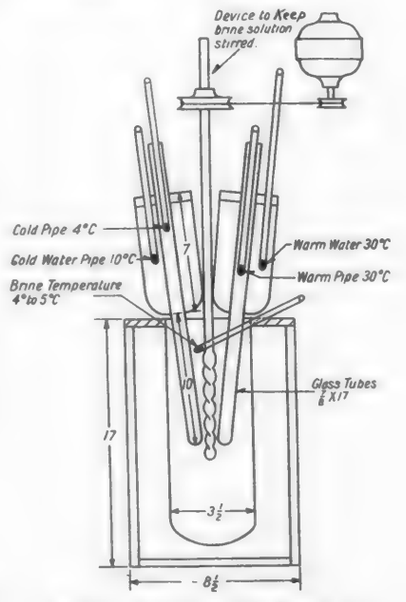
"Above this point in the pipe the water remains warmer, and since it is lighter than the the colder water below it takes no part in the circulation.

"Since the circulation extends from the point of freezing temperature to the 39° point in the pipe, the amount of water kept in circulation depends upon the height of the 39° point above the place of freezing temperature.

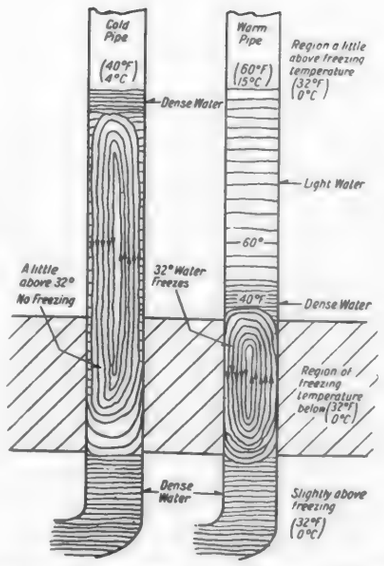
"Now, in a pipe which is kept cold, the point where the temperature is 39° naturally will be found much higher up, farther from the point of freezing, than will the similar point in the warm pipe. The amount of water kept in circulation in the cold pipe will thus be much greater than the amount that circulates in the warm pipe. The circulation in both pipes tends to keep the water at the bottom from freezing since the coldest water rises and the warmer water falls. Since there is more water in circulation in the cold pie, than in the warm, it is more difficult to freeze the cold pipe than it is the warm one, and the cold pipe will not freeze so soon as the warm one. It may not freeze at all.

"The actual water pipes in a house are not closed at the lower end, of course, but the conditions may be such that it amounts to the same thing. For there is often a horizontal stretch or pipe, along a cold ceiling, for example, just before the pipes pass a freezing cold space through a floor into a slightly warm room above. The horizontal pipe prevents convection and thus has the same effect practically as if the pipes were plugged at the bottom of the vertical portions.

"When a hot and a cold pipe pass up from a freezing region into a slightly warm room, the cold pipe may remain at about the 39° point, while the warm pipe, if slightly protected, may remain at a higher temperature long enough for the exposed portion to freeze solid. The cold water will be kept from freezing by the circulation."



Set-Up of Apparatus Used by Mr. McCulloch in His Experiment



Graphic Representation Showing Freezing in Hot Water Pipe While Cold Water Remains Unfrozen

Mr. McCulloch, a graduate of the University of North Carolina, has been with the Westinghouse Company since 1910. He has devoted the greater part of his career to the chemical end of research development.

Toronto Schools Using Ozone

Ozone equipment is being installed in one of the Toronto, Ont., schools for test purposes, according to a recent announcement of J. S. Paterson, heating and ventilating engineer of the Toronto Board of Education.

Mr. Paterson also states that his department has standardized on low-pressure boilers for the Toronto schools, with direct radiation in all rooms sufficient in amount to keep all classrooms open for business under any conditions likely to be met with in that part of the country. Fresh air supply passes through indirect heating coils, capable of raising the air from 10° below zero to 80° above and divided into tempering and reheating coils, with air washers between. Galvanized-iron ducts extend along basement ceilings and continue up to classrooms, entering on side walls directly opposite the windows. Instead of single openings, as in the old systems, double openings are used, giving better distribution. An air velocity of 300 ft. per minute at the opening is allowed for and the openings are placed rather higher than before.

Double exhaust openings are also used, with galvanized-iron ducts leading to roof space and all are connected into a main trunk line and run to a shaft. This shaft has the fresh air opening about 12 ft. above grade and the exhaust well above roof level.

Air-controlled dampers allow for a supply of fresh air, with exhaust above roof, or, by closing fresh air and exhaust dampers and opening the recirculating damper, it is possible to cut down the amount of heat required in the coils.

Chicago Oil Burner Association Elects New Officers

New officers elected at the annual meeting of the Chicago Oil Burner Association, held March 8, in the rooms of the Furniture Club, on the seventeenth floor of the Furniture Mart, Chicago, are as follows:

President, Lyle Straight; first vice-president, R. D. Barnes; second vice-president, D. M. Durkee; third vice-president, C. H. Cress; secretary-treasurer, Cliff W. Presdee, western manager of THE HEATING AND VENTILATING MAGAZINE.

President Kyle made the announcement that fire-insurance companies will honor claims from oil-burner dealers for burners damaged by fires from any cause (not oil burners) in various buildings. Following this announcement, Mr. Cress asked for expressions of experience on the part of the dealers with blanket insurance policies covering burners sold on deferred payments. Discussion revealed that some dealers were operating in this manner, but the majority operated under the assumption that the building owners' general fire-insurance policy covered the burner upon installation.

Following the report of Secretary-Treasurer Lyle Straight, which revealed a substantial growth in membership and a sound condition of the treasury, R. D. Barnes reported for the committee which was appointed to investigate the proposed course of instruction on combustion at the Hays School. It is planned to outline a course for the executives of the various companies. If this proves successful, arrangements will be made whereby the salesmen of the member companies can also participate in this educational work.

In connection with the forthcoming annual meeting of the American Oil Burner Association, in Buffalo, April 5-7, Homer Linn called special attention to the trip which the delegates are to make to the Thermal Institute of the American Radiator Company, in Buffalo, where some interesting experiments and exhibits will be seen. Mr. Linn added that for his own paper entitled "How Can Oil-Burner Dealers Make Money?," he was sending questionnaires to the members raising five major questions, replies to which were to be incorporated in his paper.

President Kyle appointed Messrs. Kauffman, Staples, and Presdee, to represent the association at the Buffalo convention.

He announced that as the result of a recent joint meeting between the tank men and the dealers, a schedule of rates had been drawn up for tank installations and tank hook-ups. This schedule will be mailed to all the members for their guidance. A number of decalcomania signs were distributed to the members, to be placed on show windows, tanks, and at other points of advantage.

E. W. Miles, in recounting happenings at the recent Western Refiners Convention, stated that reports had been made indicating an abundance of oil to be available. The indications are that prices for fuel-oil will be lower in 1927. He also explained that the recent cracking processes employed at the refineries will result in a better fuel-oil being available and that the supply is so plentiful that storage is the only problem at this time confronting the refineries. On question from R. A. Price, Mr. Miles stated that no action had been taken at the convention on the matter of standardizing oil specifications; in the opinion of Mr. Miles, this subject will readily adjust itself, in view of recent developments.

Mr. Straight announced that the railroads are attempting to bring the shipping of oil burners from Class 2 into Class 1, which would mean an immediate increase in the cost of shipping burners, which would have to be borne by the dealers.

The retiring president, Mr. Kyle, expressed his gratitude to the officers, various committees and membership, for the excellent support accorded him during his tenure in office, and turned the gavel over to the incoming president, Mr. Straight. Mr. Straight outlined some of the activities for 1927 which should make for greater progress on the part of the organization.

Central Station Heating Notes

Grand Isle, Neb. Grand Isle has turned down a proposition of the Central Steam Heat & Power Co., of Madison, Wis., to put in a heating system to take care of about 18 blocks in the business district of Grand Isle. The plan was to use the steam now going to waste in the city's utility plant. The company proposed to do all the construction work which, it was estimated, would have cost about $400,000, of which about $200,000 would have been for labor and material purchased in Grand Isle.

The company wanted the city to furnish the steam without charge. At the end of eight years the company proposed to sell the plant to the city at its original cost or, at the end of fifteen years, to turn over the plant to the city free of cost. Later extensions were provided for, if conditions justified them. In the matter of rates, the proposition was that the consumer would pay the company $1.25 per 1000 lbs. of steam used. The heating season was to be fixed from September 1 to June 30.

Chicago Oil-Burner Interests Oppose Increase in Shipping Rates

URGENT reasons why the proposed increase in shipping rates on oil-burners should not be put into effect were presented to the Consolidated Classification Committee by the Chicago oil-burner interests, at a hearing held March 10, at the Chicago Association of Commerce. The proposed increase, by changing the classification from Class 2 to Class 1, would apply to all motor-operated oil burners.

At a preliminary meeting, arranged by President Lyle Straight, of the Chicago Oil-Burner Association, data were prepared for presentation later in the day to the Consolidated Classification Committee. Those present included R. E. Murphy, Aetna; C. H. Cress, Aladdin; E. A. Weil, A.B.C.; G. Puhl, Electrol; F. C. Staples, Johnson; Donald Rosie, Lammert and Mann; W. N. Hickman, May; E. A. Anderson, Nu-Way; B. G. Kauffman, Ray; R. H. Ellerbrook, Williams Oil-o-Matic; E. T. Mureen, Winslow Kleen-Heet; Lyle Straight, Chicago Oil Burner Association; E. Hennigan, traffic manager, Bloomington Chamber of Commerce, and Cliff W. Presdee, western manager, THE HEATING AND VENTILATING MAGAZINE.

Data were compiled relating to various burners, ready for shipment, including outside dimensions, weight per package, weight per cubic foot, value per pound of shipping weight, to what extent the burner is knocked down, and brief description of burner. The present ruling provides for separate shipping of the thermostat, the value of which is not included in the shipping valuation.

The formal hearing before the Consolidated Classification Committee was held in the afternoon at the committee's offices in the Chicago Union Station. In addition to those present at the preliminary meeting, those at the hearing included C. S. Bather, Commerce counsel, Rockford, Ill., representing Sundstrand; D. M. Durkee, Rayfield; C. E. Shields, American Nokol; and L. A. Sauer, Hardinge.

Mr. Ellerbrook presented a long brief to the committee, and argued for the consideration of the huge expenditures of the industry for experimentation, buildings, equipment and other investments on which the industry had yet to realize. He also argued an anticipated drop in the selling price of burners. Mr. Mureen argued in support of the briefs he submitted to the committee at this hearing and a previous hearing. Mr. Bather made a comparison to classification of gas-fired furnaces, and was followed by Mr. Anderson.

Mr. Cress urged the necessity for the fostering, rather than hindrance, of a new industry and the anticipated evolution of the industry to that which the mechanical refrigeration industry has passed through. Mr. Weil emphasized the enormous capital invested necessarily in the industry, and the short time the industry has been functioning, in his argument against the placing of further burdens upon the industry. Mr. Puhl referred to the extremely low number of claim cases on damaged burners and referred to his company's practice of shipping in boxes almost equal to the weight of the burner. Messrs. Durkee, Shields, Staples and Murphy, also spoke before the committee and Mr. Sauer referred to his complete briefs filed with the committee.

A brief from the Chicago Oil Burner Association was filed, protesting the burden which increased rates would bring upon the dealers. Another brief was filed by THE HEATING AND VENTILATING MAGAZINE.

A decision by the committee is expected in about thirty days.

The Heating and Ventilating Magazine's Brief

March 10, 1927.

Consolidated Transportation
Committee,
Union Station,
Chicago, Illinois.

Subject: Proposed increase in shipping rates on oil burners.

This brief is being submitted by THE HEATING AND VENTILATING MAGAZINE—a publication devoted to serving the heating industry for the past twenty-four years and the oil-burner industry since its inception. The very purpose of the magazine and the service it renders makes necessary the keeping in constant touch with conditions obtaining in, and affecting, the oil-burner industry.

It is believed that any increase in the shipping costs of burners at this time would inflict a hardship upon the entire oil-burner industry.

The progress of the oil-burner industry has been remarkably rapid, yet the industry is still burdened with many problems and conditions which are reflected in the cost of doing business by all in the industry. The majority of oil-burner dealers and distributors operated at a financial loss during the past year. This unfavorable condition has been definitely traced to conditions which always surround a new industry. In addition, unfair trade practices and unfavorable competition are two conditions which are largely reflected in the dealers' cost of doing business. The necessity of securing permits from municipalities and town boards at varying prices is another condition the dealers have had to meet and the ordinances authorizing the collection of permit fees also, in the majority of instances, provide for regulation of installations and conditions, the cost of which must be borne by the dealer.

It is to be remembered that the oil-burner dealer is unlike a great many other retailers in that when a sale is made the oil-burner dealer's liability and responsibility is immediately increased. The lack of intimate knowledge on the part of owners of oil burners results in a preponderance of service calls which inflict a financial hardship on the dealer, and in this is found one of the main reasons for the high cost of the dealer doing business. The turn-over in dealers, as well as the mortality of dealers in the oil-burner industry, has been very high, which is mentioned as sound evidence of the enormous cost of retailing oil burners.

Thus, the granting of the proposed increase in shiping rates would seriously handicap further the oil-burner industry. The dealer, in view of the competition referred to, cannot pass the additional cost on to the public. The increase will have to be absorbed by the industry, and if absorbed by the dealer it will be reflected in the manufacturer's cost of doing business; and, if absorbed by the manufacturer, it will of necessity, in some form, have to be passed on to the dealer.

From all of the facts and data available, the oil-burner industry at this time would find any increase in the cost of shipping rates a burden of serious proportions, and action might well be deferred until such time as the industry has been relieved of some of its present burdens.

THE HEATING AND VENTILATING
MAGAZINE.
By Cliff W. Presdee,
Western Manager.

The Alden Park Manor Group in Brookline, Mass.

Large Apartment-House Groups Find Economy in Oil Fuel

Past Experience of Owners Leads to Adoption for New Construction

IN preparing the story on the heating plant in the Alden Park Manor groups of buildings in Detroit, Brookline, Mass., and Philadelphia, which appeared in THE HEATING AND VENTILATING MAGAZINE, for March, under the title "The Largest Low-Pressure Cast-Iron Boiler Installation in the World," the story was inadvertently written to carry the implication that the heating equipment was identical in all of these groups.

Following the appearance of the March issue of the magazine, information has been received to the effect that the Alden Park Manor group in Brookline, Mass., was equipped with Holby burners, formerly known as Sunbeam burners, during the 1926-27 heating season and that approximately half of the burner installation for the 1925-26 heating season consisted of Sunbeam burners.

Correction also should be made to this article in connection with the burner installation in the Alden Park Manor group in Germantown, Pa., and the Kenilworth apartments also in Germantown and owned by the same interests. In the former group, consisting of three buildings, containing 271 apartments, four Sunbeam burners have been in service during the past heating season, carrying approximately half of the heating load, and in the Kenilworth apartment group, which is now under construction, the Frank A. Holby Corporation, New York, has been given the contract to furnish the entire burner equipment. Mention can also be made of the fact that the 250-car garage, operated in connection with the Alden Park Manor group in Brookline, Mass., is heated with a separate heating plant, fired with a Holby burner. This boiler also carries the kitchen load.

The operating engineer at Brookline, D. V. Fox, has kept a careful record of oil consumption for the past two heating seasons, and the data collected by him will form the basis of a technical analysis, of the cost of heating apartment buildings of this kind, which will appear in an early issue. The owners of these properties feel that much of the success of the installation has been due to the care with which the burners were put in under the supervision of J. T. McCarnahan, who is now field engineer of the Frank A. Holby Corporation.

The Kenilworth Apartments, the Latest Park Manor Group, in Germantown, Pa.

Installation of Holby Oil Burners in Cast-Iron Sectional Boilers in Alden Park Manor Group in Brookline, Mass.

LIST OF INSPECTED GAS, OIL AND MISCELLANEOUS APPLIANCES as of January, 1927, has been published by the National Board of Fire Underwriters as a supplement to the July, 1926, list. Oil burners classified as domestic are those machines, irrespective of size or heating capacity, which are suitable for use where an attendant is not constantly on the premises and are provided with automatic devices for the prevention of abnormal discharge of oil at the burner. Burners of this class are intended principally for heating dwellings, but may be permitted by authorities having jurisdiction for use in industrial plants and for heating apartment houses and the like. Unless otherwise designated on the individual cards, these burners may be installed in either steam, hot-water, or hot-air installations.

The labels now authorized by the Underwriters for the mechanical draft and gravity types read as follows:

Underwriters' Laboratories'
Inspected
Domestic Oil Burner
Natural Draft No. N.....

Underwriters' Laboratories'
Inspected
Domestic Oil Burner
Mechanical Draft No. M....

No less than 49 domestic oil burners and one industrial oil burner are included in this list.

Economy of Unit Heaters for Factory Heating

FOUR 18-inch unit heaters are used to warm the new shops of the Excelso Specialty Works, Buffalo, N. Y. They represent an investment of 26% of that required for an equivalent of 2400 sq. ft. of direct radiation.

The company makes the Excelso line of water heaters. New quarters were occupied 18 months ago — a one-story brick and steel building, 185 ft. long and 60 ft. wide. The shops have an area of 9300 sq. ft., with brick walls on three sides and the office wall on the fourth. The height from floor to flat roof is 15 ft.

The outside exposures are approximately 5500 sq. ft. of 8-in. brick wall, 2000 sq. ft. of glass and 9300 sq. ft. of roof. This shop is maintained at a temperature of from 65° to 68° F. and the U. S. Weather Bureau reports show minimum temperatures of from —3° to —7° from December 1, 1925, to March 31, 1926, thus giving a maximum difference in temperature of about 70°. The shop would require 2400 sq. ft. of direct radiation, had that been chosen.

The heating season is about 180 days and the average temperature from October to the end of March is 33° F.

HEATING PLANT

An oil-fired Ideal boiler rated at 5500 sq. ft. of direct radiation supplies steam at 2 to 5 lbs. pressure, under both pressure and temperature controls.

Steam is supplied to four 18-in. Breezo-Fin unit heaters, supplied by the Buffalo Forge Company, in the shop area, and to a hot water system for the offices. The latter consists of two Excelso water heaters, a centrifugal pump to give positive circulation, and direct radiation placed at floor level. The pump motor is under thermostatic control to insure a uniform temperature.

OPERATION

A survey of the installation, made by Nielsen Surveys, of Chicago, showed the system to be very flexible, besides being easily installed and requiring comparatively little space. The boiler is under steam only when heat is required and the U. S. Weather Bureau bulletins are consulted to determine whether heat is required during the night to prevent freezing. An auxiliary gas heater, with automatic valves, permits heating the offices when steam is not required for the shop.

The four unit heaters in the shop are practically never all used, two being sufficient for the coldest days. They are so disposed as to drive warmed air throughout the entire shop area. In mild weather only one unit is required. All are under individual push-button control. During the night steam may be left on the radiators but without running the fans. Sufficient radiation is exposed to keep the temperature above freezing.

CIRCULATION OF AIR

Since the heaters take in air at floor level and discharge near the ceiling, a continuous movement of air in large volume takes place, which tends to keep all parts of the room at even temperature. That this is effectively done is proved by the fact that normally two of the four heaters satisfactorily heat a space 60 ft. x 155 ft. in area.

EASE OF INSTALLATION

The heater units are light in weight and were easily installed, requiring only two pipe connections to the boiler and electric current supply. As installed at this plant, no traps are required, nor pumps to return condensate to the boiler. These auxiliaries were ordered for the job but had not arrived when heat was needed and the units were connected up without them. Operation was so satisfactory that the order for auxiliaries was cancelled.

Direct radiation at floor level would have required either that a basement be provided for the boiler or that return traps and pumps be used. With the Breezo-Fin unit system, the radiators are set high enough above the floor so that condensate could be returned by gravity to the boiler.

SAVINGS

The system is now in its second year of service. The unit heaters have required no repairs. Maintenance is estimated at not over $5.00 a season for oiling and cleaning. The power required for the ¼-H.P. fan motors is a small item, two only operating during the coldest days and none at night.

Fixed costs, including depreciation and average interest at 6%, based in each case upon a life of 15 years, amount to $89.29.

Some economy is also to be expected in fuel cost with the air in constant movement and at uniform temperature —the conditions obtaining with the unit heaters. This saving would be an appreciable but not large percentage of the present fuel oil consumption, which averages 1000 gal. a month during the heating season.

The annual saving in fixed charges is equivalent to 29% of the first cost of the heaters.

FIXED COSTS

Four 18-in. units	
Depreciation,—$905.00 ÷ 15-year life	$ 60.33
*Average interest at 6%, + 16/15 x $905.00 x .06/2	28.96
Total	$ 89.29

SUMMARY

Factory has 9300 sq. ft. of shop floor.

Would require 2400 sq. ft. of direct radiation.

Four unit heaters installed.

Two found sufficient in coldest weather.

No traps required.

Fan motors run in day-time only.

Power cost almost negligible.

Maintenance $5.00 a season.

*Allowing for interest earned by depreciation reserve.

Unit Heater Installation in Plant of Excelso Specialty Works

PIPE

Explanation of Pipe Table

In the Pipe Table (Data Sheet No. 50), compiled by Harold L. Alt, no pretense is made of presenting new or original figures, for pipe dimensions and the quantities deduced from these dimensions necessarily are fixed by the pipe standards adopted. Credit should be given to the National Tube Company, the American Radiator Company and the Pittsburgh Piping & Equipment Company, from whose catalogs a large part of the figures presented were secured.

The Pipe Table is especially designed to fill a demand for handy information regarding pipe characteristics, the tables in common use failing to give all the information desired. How many pipe tables, for instance, give the weight of water in an 8-in. riser 10 ft. high? How many of them give the size or length of a coupling? How many list the gallons of water contained per lineal foot?

In the pipe table, given in Data Sheet No. 50, the large figures in the first column on the left are the nominal sizes of pipe which, of course, are the common trade designations regardless of the variations of the actual dimensions from this nominal size. The nominal size is, really, only the approximate inside diameter.

In the second column, proceeding toward the right, is given the actual inside diameter, and a comparison between the two columns will immediately demonstrate the difference between the nominal size and the actual size.

The third column from the left is the actual outside diameter, this being equal to the actual inside diameter, plus twice the thickness of the metal, which is shown in the next column to the right.

Under the heading of "Transverse Areas" there is given, in the first column, the actual area of the opening through the pipe; the second column, under "Transverse Areas," gives the cross-sectional area of the metal when the pipe is cut through, perpendicular to its longitudinal axis. The third column gives the area which the pipe would occupy, for instance, if inserted in a plate; in other words, it is the area of a circle whose diameter is the actual outside diameter of the pipe. This area is equal to the inside area plus the area of the metal.

For the three columns under the general caption of "Weight per Foot," the first shows the weight of the pipe per lineal foot for the metal only. The second column under this heading is the weight of the water per lineal foot which would be contained in the pipe, and the third column, the sum of the first two columns or the combined weight of both water and pipe.

Passing again to the right, under the general heading of "Exterior and Interior Surface" are found four columns, the first column on the left being the number of square feet of surface on the outside of the pipe per lineal foot, and the next column to the right, the square feet of surface on the inside of the pipe per lineal foot.

The third and fourth columns under this heading are similar to the first and second except that these columns give the lineal feet of pipe to 1 sq. ft. of outside surface and to 1 sq. ft. of inside surface, respectively. Column 3 naturally is the reciprocal of Column 1, and Column 4 is the reciprocal of Column 2.

Passing again to the right is found the heading of "Circumference," under which are two columns, the first showing the outside circumference of the pipe, and the second, the inside circumference.

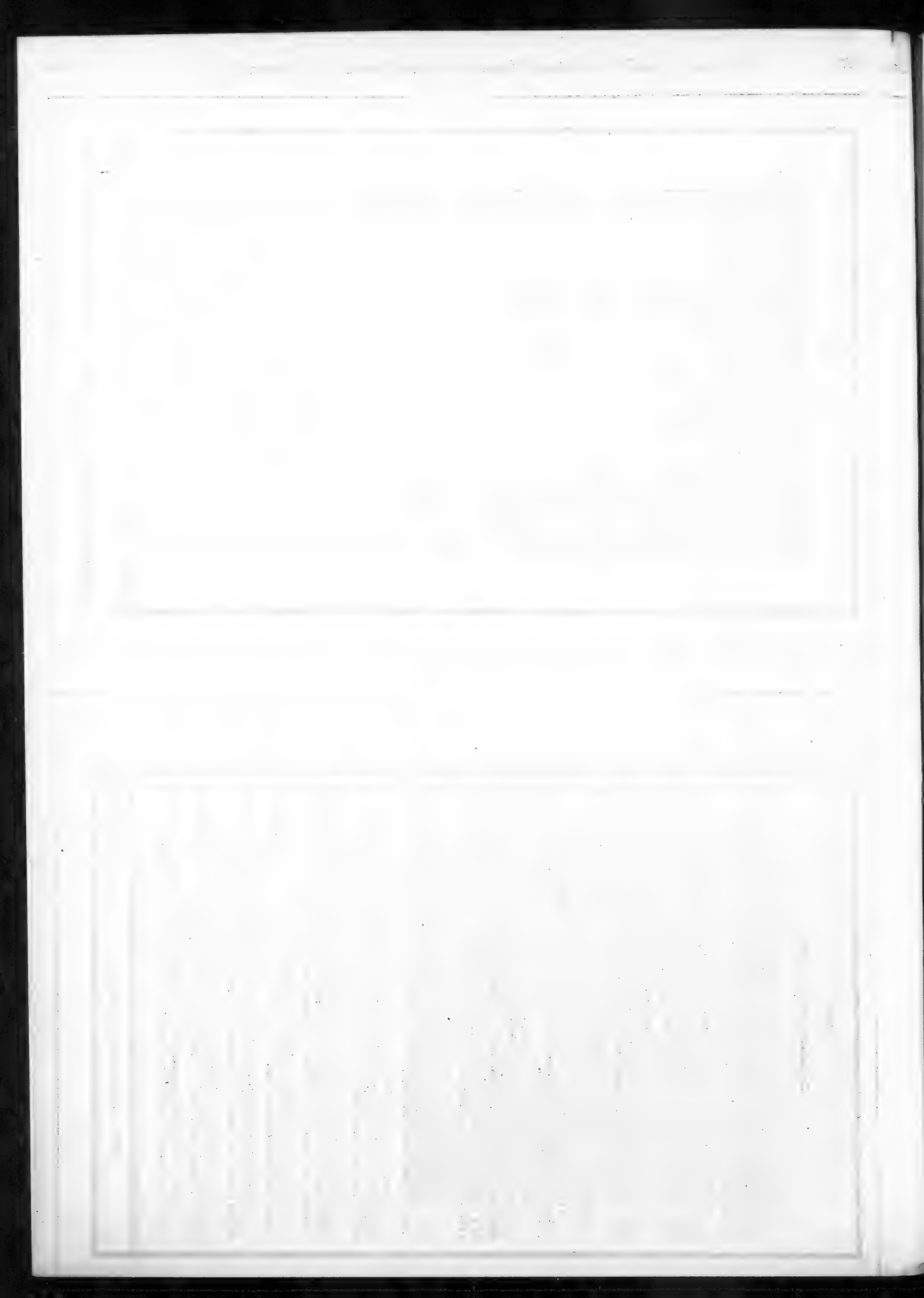
Again going to the right is found the heading "Capacities" under which, in the first column, is shown the gallons of water contained in 1 lin. ft., of pipe and, in the second column, the number of lineal feet of pipe required to contain 1 cu. ft.

The next heading is "Thread and Tap," under which the first column indicates the number of pipe threads per inch and the second column, the size of the tap drill to use in tapping out a thread to fit the thread on the pipe.

Finally, under the last general heading of "Pipe Couplings" is found the diameter of the coupling, the length of the coupling, and the weight of the coupling.

PIPE TABLE

DIMENSIONS OF PIPE			TRANSVERSE AREAS			WEIGHT PER FOOT			EXTERIOR AND INTERIOR SURFACE			CIRCUMFERENCE		CAPACITIES		THREAD AND TAP		PIPE COUPLINGS		
NOMINAL SIZE OF PIPE	ACTUAL INSIDE DIAM.	ACTUAL OUTSIDE DIAM.	THICKNESS OF METAL	INSIDE	METAL	OUTSIDE	PIPE	WATER	PIPE AND WATER	OUTSIDE PER LIN. FT	INSIDE PER LIN. FT	LENGTH FOR 1 SQ. FT. OUTSIDE	LENGTH FOR 1 SQ. FT. INSIDE	INSIDE	OUTSIDE	FOR 1 LIN. FT.	LENGTH CONTAINING 1 CU. FT.	THREADS PER INCH	SIZE OF TAP DRILL	DIAMETER	LENGTH	WEIGHT
IN.	IN.	IN.	IN.	SQ. IN.	SQ. IN.	SQ. IN.	LBS.	LBS.	LBS.	SQ. FT.	SQ. FT.	LIN. FT.	LIN. FT.	IN.	IN.	GAL.	LINEAL	NO.	IN.	IN.	IN.	LBS.
1/8	0.270	0.405	0.068	0.0573	0.0717	0.129	0.241	0.0344	0.2658	0.106	0.0706	9.44	14.13	0.848	1.272	0.0030	2513	27	1/16 in	0.562	3/8	0.029
1/4	0.364	0.540	0.088	0.1041	0.1249	0.229	0.420	0.0601	0.4650	0.141	0.0955	7.07	10.49	1.144	1.696	0.0055	1383	18	1/16	0.665	1	0.043
3/8	0.494	0.675	0.091	0.1917	0.1683	0.358	0.557	0.0830	0.6430	0.177	0.1293	5.66	7.73	1.532	2.121	0.0100	751.2	18	9/16	0.849	1 1/8	0.070
1/2	0.623	0.840	0.109	0.3048	0.2492	0.554	0.837	0.1320	1.969	0.220	0.1651	4.53	6.13	1.957	2.639	0.0057	472.4	14	9/16	1.021	1 1/8	0.116
3/4	0.824	1.050	0.113	0.5333	0.3327	0.866	1.115	0.2309	1.346	0.275	0.2157	3.64	4.64	2.589	3.299	0.0027	270.0	14	5/8	1.281	1 1/8	0.209
1	1.048	1.315	0.134	0.8626	0.4924	1.358	1.668	0.3735	2.041	0.346	0.2748	2.90	3.65	3.292	4.131	0.0044	168.9	11½	1 3/16	1.567	1 1/8	0.343
1¼	1.380	1.660	0.140	1.496	0.668	2.164	2.244	0.5417	2.892	0.434	0.3632	2.30	2.77	4.335	5.215	0.0076	96.25	11½	1 5/8	1.950	2⅛	0.535
1½	1.611	1.900	0.145	2.038	0.797	2.835	2.678	0.8824	3.560	0.494	0.4217	2.01	2.37	5.061	5.969	0.0105	70.65	11½	1 7/8	2.218	2⅜	0.743
2	2.067	2.375	0.154	3.356	1.074	4.430	3.609	1.453	5.062	0.622	0.5412	1.61	1.85	6.494	7.461	0.174	42.91	11½	2 3/8	2.760	2½	1.208
2½	2.468	2.875	0.204	4.784	1.708	6.492	5.739	2.071	7.810	0.753	0.6461	1.33	1.55	7.753	9.032	0.245	30.10	8	2 3/4	3.276	2½	1.720
3	3.067	3.500	0.217	7.388	2.243	9.621	7.536	3.199	10.735	0.916	0.803	1.09	1.25	9.636	10.996	0.364	19.50	8	3 3/4	3.948	3⅜	2.498
3½	3.548	4.000	0.226	9.887	2.679	12.566	9.001	4.281	13.28	1.175	0.929	0.955	1.00	11.146	12.566	0.514	14.57	8	3 3/4	4.591	3½	4.241
4	4.026	4.500	0.237	12.730	3.174	15.904	10.665	5.512	16.18	1.455	1.054	0.849	0.949	12.649	14.137	0.661	11.31	8	4 1/8	5.091	3½	4.741
5	5.047	5.563	0.259	19.990	4.316	24.306	14.502	8.656	23.16	1.739	1.321	0.687	0.757	15.849	17.477	1.04	7.20	8	—	6.296	4½	6.091
6	6.065	6.625	0.280	28.888	5.184	34.478	18.762	12.51	31.27	1.996	1.580	0.577	0.630	19.054	20.813	1.50	4.99	8	—	7.363	4½	9.554
8	7.982	8.625	0.322	50.04	8.366	58.428	28.177	21.67	49.85	2.457	2.090	0.443	0.478	25.07	27.096	2.60	2.88	8	—	9.328	4½	13.90
10	10.09	10.750	0.366	78.84	11.924	90.763	40.085	34.14	74.20	2.814	2.623	0.355	0.382	31.49	33.77	4.09	1.82	8	—	11.72	6⅛	29.80
12	12.000	12.750	0.375	113.10	14.60	127.70	49.56	48.97	98.53	3.338	3.142	0.300	0.315	37.70	40.06	5.87	0.70	8	—	13.96	6⅛	43.10



Correspondence

Heat Transmission Through Hollow Building Blocks

By T. W. Reynolds

THE results of the tests illustrated by accompanying sketch (Fig. 1) as reproduced from THE HEATING AND VENTILATING MAGAZINE for December show the possibilities of greater insulation for a building block by interposing occasional horizontal webs so as to break up the continuity of the long, vertical flues and thus effect a saving in heat from decrease in convective currents. In lieu of this method the air spaces may be filled with materials of a poor conductivity, such as gravel, or preferably sawdust.

Tarred or asphalted felt, tarred or asphalted papers and heavy waterproof papers are of great value in reducing heat losses through walls. It also may be pointed out that air spaces greater than ¾ in. thickness give no additional value for heat-insulating purposes.

As a general rule, it is possible to compute the heat transmission through any material to a degree of accuracy closely approaching that obtained by test by making use of well-known formulae for simple and compound walls and air spaces. This may be done as follows hereafter, assuming coefficients of conductivity for the materials in question as given in University of Illinois Bulletin No. 12 entitled "A Study of the Heat Transmission of Building Materials."

Before proceeding with the formula it may be pointed out that the heat conductivity of a material, expressed in B.T.U. per day (24 hrs.) per square foot of surface per degree F. difference in temperature between the surfaces of the material, is about equal to the density of the material, expressed in pounds per cubic foot; in other words, the best insulations have the least density.

Gypsum, weighing from 60 to 72 lbs. per cubic foot, or, say, 65 lbs., would have a conductivity expressed in the above terms of 65 B.T.U. per degree, 2.7 B.T.U. per hour for a thickness of 1 in., or 0.23 B.T.U. for a thickness of 12 in., thus $(65 \div 24) \div 12 = 0.226$. If the weight of the material is other than the weight assumed, then the result obtained by the formula will be different. Incidentally, the weight of stone concrete (1:2:4 mixture) has been taken as 140 lbs. per cubic foot and the conductivity for a thickness of 1 in. as 8.3 B.T.U.

For the particular type of construction in question it has been assumed that 52.3% of the wall is built with air spaces, 26.8% as concrete supporting columns combined with a gypsum form and 20.9% as a solid wall of gypsum, the last percentage being that required in order to compute the proportionate amount of heat transmission through the center web and ends of the hollow blocks.

Let C_1 and C_2 represent the different conductivities of the various materials; X_1, X_2 and X_3, the various thicknesses of these materials; K_1, K_2, K_3 and K_4, the different surface coefficients, and U the total heat transmission through the combined wall in British thermal units per square foot per hour per one degree of temperature difference between the inside and outside of the wall. Let all coefficients for K be taken as 1.45 for "still air" conditions, except that for the outside wall the surface coefficient K_4

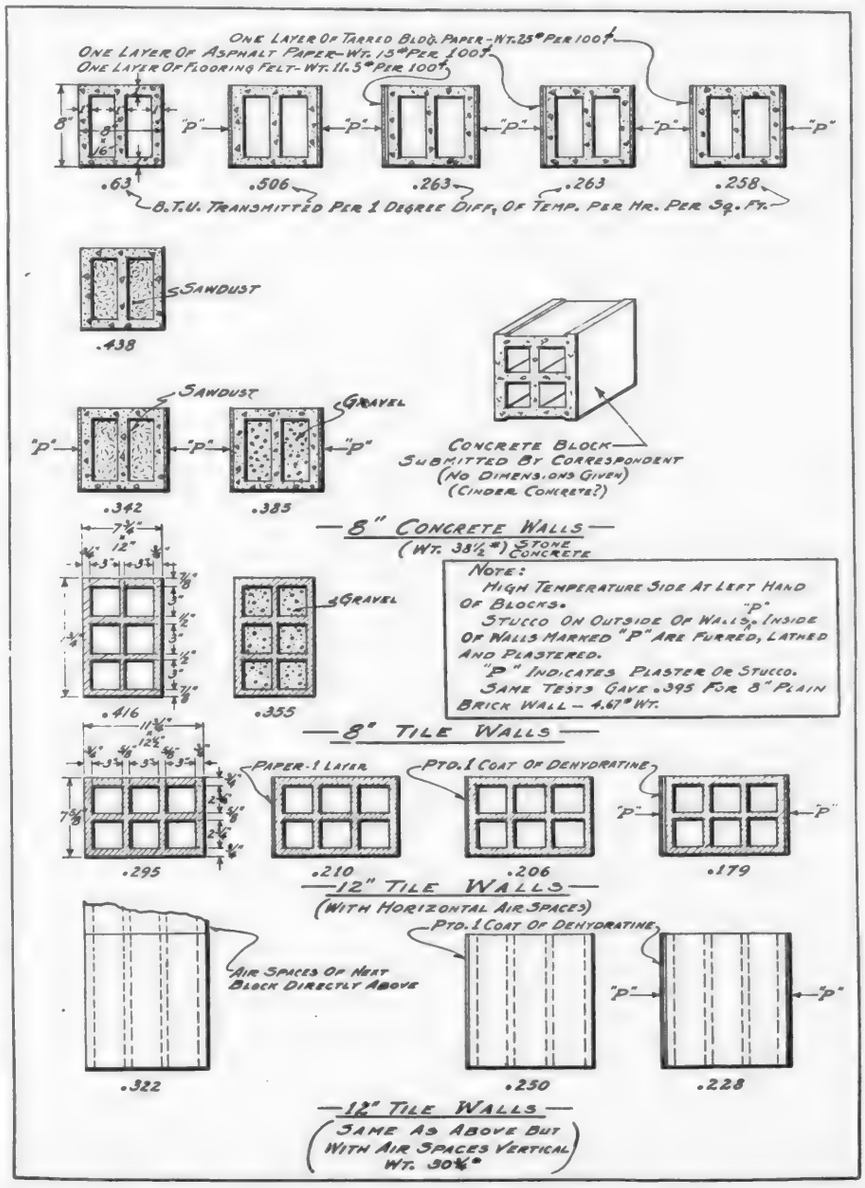


Fig. 1. Temperature Co-efficients for Various Types of Block Construction

must be K_1 multiplied by 3 as noted in the formula.

Then, for the combined wall the formula is

$$\frac{1}{\frac{1}{K_1}+\frac{1}{3K_2}+\frac{1}{C_1}+\frac{6}{C_2}+\frac{0.75}{C_1}}=U$$

Substitute values of 1.45 for K, 2.7 for C_1 and 8.3 for C_2 and U becomes 0.437 B.T.U. per square foot of combined wall, or 0.117 at 26.8 per cent.

For the wall with gypsum form and air spaces the formula gives 0.339 B.T.U., thus,

$$\frac{1}{\frac{1}{1.45}+\frac{1}{1.45}+\frac{1}{1.45}+\frac{2}{3\times1.45}+\frac{1}{8.7}+\frac{0.75}{2.7}}=$$

0.339, or 0.178 at 52.3 per cent.

For the center web and ends the formula gives

$$\frac{1}{\frac{1}{1.45}+\frac{1}{3\times1.45}+\frac{6}{2.7}}=$$

0.258 B.T.U., or 0.054 at 20.9 per cent.

Adding, 0.117 plus 0.178 plus 0.054 equals 0.35 B.T.U., the average heat loss, which may be reduced by an amount corresponding to the reduction in Fig. 2 for walls painted one coat of waterproofing, thus 0.35 — 0.07 = 0.28.

Stucco on the outside surface would effect a still further reduction, changing the amount to, say, 0.25, or 4-in. *brick veneer construction would change the quantities, 0.437 to 0.306, 0.339 to 0.255 and 0.228 to 0.204, and make the average loss for the wall, 0.20 B.T.U. per square foot per hour per degree of temperature difference. This figure is very close to that as given in Fig. 2 for a 12-in. waterproofed tile wall having horizontal air spaces.

Although the final result appears reasonable, it must be kept in mind, when comparisons are made with other types of wall construction, that the result is one derived from certain figures, some of which, though of less importance, are nevertheless assumed. It should be noted further that the number of variables entering into the problem also tend to some slight inaccuracies. It is suggested that, where positive results are desired, this or any other type of construction similarly involved be submitted to the known conditions of test. The calculations are given more as an illustration of how the heat losses through various types of construction may be approximated in the absence of test data, especially when the weights of the materials used and other factors are better known.

*For brick, C = 4.00 and K = 1.4.

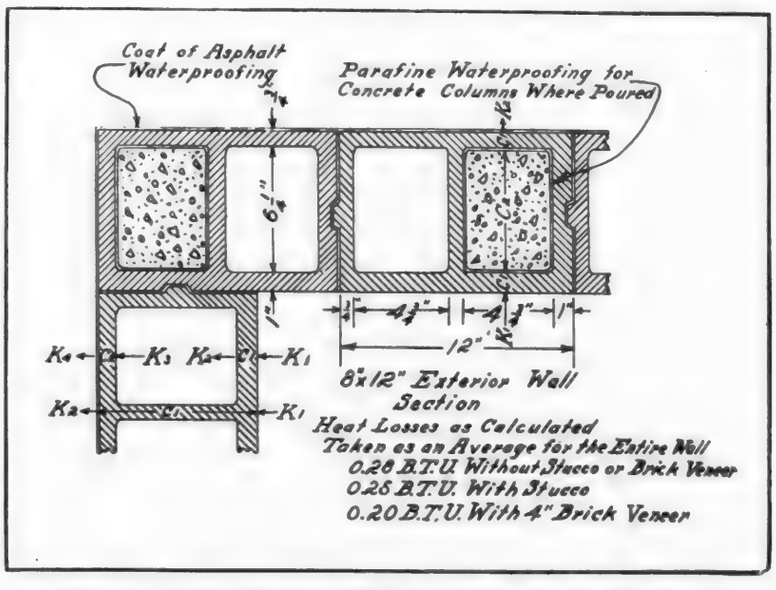


Fig. 2. Typical Exterior Wall of Building Blocks, Showing Preliminary Data for Figuring Heat Losses

Should a Single Boiler Be Equipped with a Stop Valve?

EDITOR HEATING AND VENTILATING MAGAZINE:

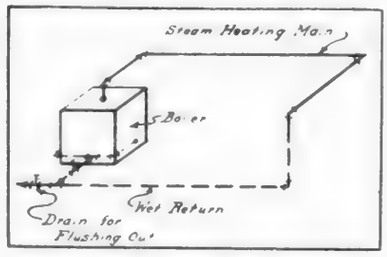
Is a stop valve necessary on a single boiler?

S. P.

A gate valve installed on each side of a boiler is necessary only where hydrostatic pressure tests are required. Nevertheless, some claim that these valves are necessary for the purpose of shutting off the boiler whenever it is desired to raise the pressure and clean out the boiler. However, the system as a whole, and not alone the boiler, should be so treated at the same time; hence the use of two valves for this purpose is unnecessary.

The best arrangement for cleaning out the boiler and system is shown in the accompanying illustration, no valve being used on the steam main, although one should be installed on the return. This is opened when cleaning out, putting some water pressure on the boiler, in the meantime, the fire heating this as fast as it comes through. During this time the drain valve is opened so that the system may be thoroughly flushed out.

If for any reason it should become desirable to quickly remove steam from the heating system by isolating the boiler, this easily may be done even without valves on the boiler. All that is necessary is to smother the fire with damp ashes, or even blanket it with soft coal where only a temporary drop in pressure is quickly desired, then open the fire door and stack damper so as to let cold air blow over the heating surfaces. As for the steam in the boiler and system, this can quickly be released by holding open the safety valve. In fact this last method will often be found sufficient.



Good Arrangement for Cleaning Out Boiler

A twin or duplex boiler should be treated as two boilers and not as a single boiler, as is often done. Separate steam and return headers should be installed and each valved, so that one boiler can be drained without emptying the other.

Pressure-Drop as Affected by Commercial Pipe Sizes

EDITOR HEATING AND VENTILATING MAGAZINE:

Why is it that we carefully design our heating systems for a certain predetermined pressure-drop, then select a pipe size which, although nearest that desired, is not that computed by formula for the pressure-drop selected?

C. E.

Commercial pipe-sizes do limit us somewhat in our selection of pipes. However, the pipe selected should be the nearest commercial size above rather than below the exact size computed by pressure-drop formula. The error thus is on the safe side. Furthermore, the pressure-drop is usually assumed for the longest run so that the chance favoring of one pipe by being a bit larger than required, as compared with some other pipe which happens to have a commercial size exactly that required by formula, will not be of any serious moment.

The present tendency for simplification is to decrease the number of pipe sizes. It would cost too much to place on the market exact odd sizes of pipes, together with corresponding sizes of valves, fittings, specialties and covering, just to agree with the various pressure-drops. Any advantage obtained by such a questionable refinement would be more than offset by the effect of severe pressure-drops occasioned through failure to properly ream pipes.

All radiators of a job eventually may heat up to an equal point, but, in starting up, some radiators are quicker to

heat than others, hence the velocities and pressure-drops often vary widely at times throughout different parts of a heating system.

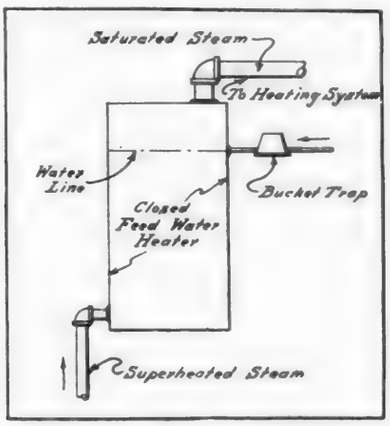
Desuperheating Steam for Heating

EDITOR HEATING AND VENTILATING MAGAZINE:

Will you please tell me what practical means there are, if any, for reducing the high temperature of superheated steam so as to make it suitable for use in heating systems?

B. W.

The excess of temperature in superheated steam can be eliminated by the simple process of transmitting it through the tube surface of a feed-water heater, so as to evaporate the surrounding water into saturated steam. The arrangement can easily be made, somewhat as shown in the accompanying sketch, using a bucket type of trap



Arrangement for Desuperheating Steam

turned upside down so as to control the water level and further to insure that water will always be present.

Another method of accomplishing the desired result may be obtained by means of a simple receiver or tank, in which a number of water nozzles spray the steam on its way through the tank, thus providing sufficient evaporating effect to destroy the high superheat which otherwise would be present. In both cases, safety or back-pressure valves should be used for protecting the low-pressure system from any responsibility of excess pressure.

Elongation of Fittings in Service

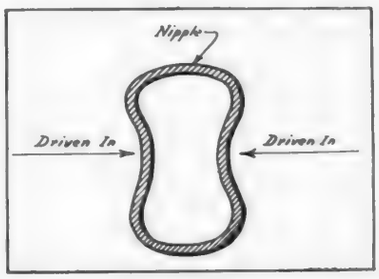
EDITOR HEATING AND VENTILATING MAGAZINE:

Do fittings lengthen slightly after many years of service? It would seem so from measurements taken on some very old fittings in this plant.

H. D.

A certain plant generated superheated steam which varied from one extreme to the other because of variable load, poor design, engines pulling over wet steam, boilers poorly fired or frequently cut in or out.

Upon a general inspection of the pipe fittings, because of trouble from leaks, it was found that a number located at



How Fittings Become Elongated

points of stress had elongated, in a few years, as much as ¾-in. Experiments then made following the insertion of new fittings, carefully measured, showed a definite elongation each time that they were examined. This seems to prove that pipe fittings do become permanently elongated under favorable conditions.

Wrong Connections for Heating Domestic Water from Heating Boilers

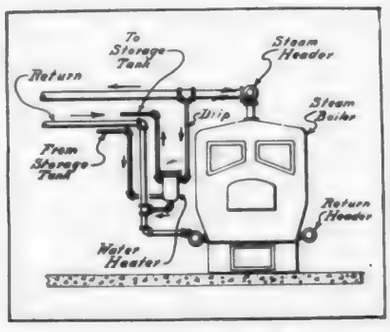
EDITOR HEATING AND VENTILATING MAGAZINE:

A domestic water heater connected to a steam heating boiler, one end as a drip to the steam piping, and the other end to the return piping, as sketched, fails to do much heating of water in the water storage tank. The manner of making these connections has been criticised. Will you kindly favor me by your comments upon this point?

C. H. P.

The form of connections shown would be more suitable for a domestic water heater when heating from a house water heating boiler—in such a way a greater circulation being set up through the auxiliary heater, due to connecting one end to a point where the water is hottest, and the other end to a point where the water is coldest.

In the present case both ends of the auxiliary heater should connect to the boiler below the water-line. This allows the hot water of the boiler to circulate through the heater as it will, due to its own cooling action and difference in temperature between the water in the top and bottom of the boiler. With connections as now shown there will be no heating of the water from the steam header whenever the steam pressure dies down.

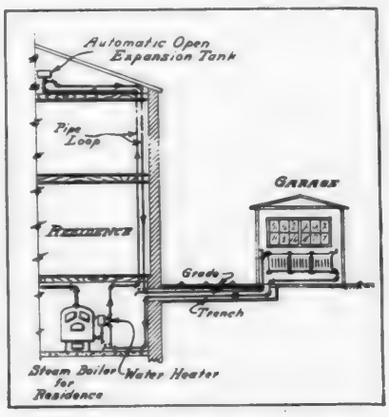


Connections for Heating Domestic Water from Heating Boiler

Heating Garage Near Water Level of House Boiler by Means of a Combination Steam and Water Heating System

EDITOR HEATING AND VENTILATING MAGAZINE:

In connection with the item upon heating of a garage near the water level of a house boiler, as published on page



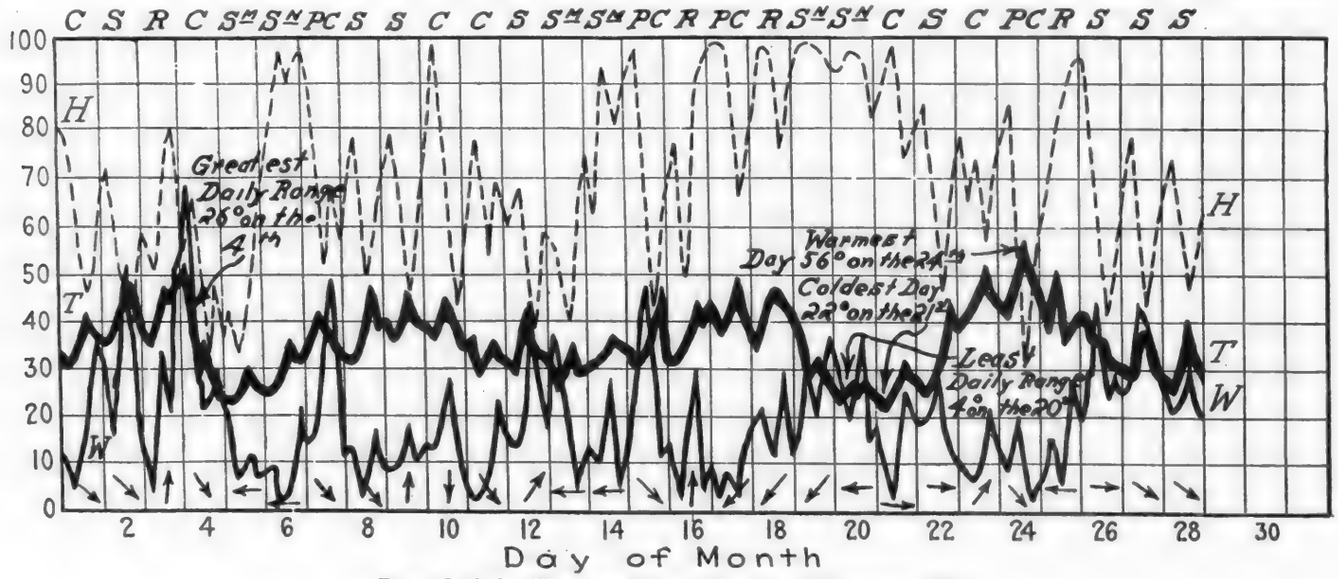
Method of Running Heating Connection from House to Garage

102 of THE HEATING AND VENTILATING MAGAZINE for February, the following sketch is offered as a simple solution of the problem. This is often done where pitting of the boiler otherwise would be required.

Briefly, the method to use consists of heating the garage by means of water heated through circulation in any of the now numerous auxiliary heaters so generally used for heating domestic water, when attached to a steam boiler. For the purpose of establishing sufficient motive head for water circulation, the hot-water supply pipe from the auxiliary heater is carried up, first to the open expansion tank in the house, at which point the air is vented. Then the pipe returns without covering as a cooling drop to the cellar, from which point it is extended underground to the garage and returned in the usual manner. This method has also the advantage that flow and return to garage may be run in the same boxing or covering, and at a depth no greater than frost line.

The Weather for February, 1927

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, deg. F	56	49	66	56	70
Date of highest temperature	24	4	16	22	5
Lowest temperature, deg. F	22	11	20	16	21
Date of lowest temperature	21	5	11	10	19
Greatest daily range, deg. F	26	30	31	23	29
Date of greatest daily range	4	4	16	21	21
Least daily range, deg. F	4	5	5	4	6
Date of least daily range	20	17	20	18	27
Mean temperature for month, deg. F	36.6	32.6	38.1	35.0	43.2
Normal mean temp. for month, deg. F	31.3	28.8	32.3	26.3	34.8
Total precipitation, this month, in	3.33	3.28	3.97	0.75	0.56
Total snowfall, this month, in	3.6	19.1	21.0	1.3	2.1
Normal precipitation, this month, in	3.74	3.44	2.66	2.16	2.75
Total wind movement, this month, miles	11304	7028	8699	8639	8236
Average hourly wind velocity, miles	16.8	10.5	12.9	12.9	12.3
Prevailing direction of wind	N.W.	S.W.	W.	N.W.	N.
Number of clear days	7	5	6	10	8
Number of partly cloudy days	9	12	9	5	5
Number of cloudy days	12	11	19	13	15
Number of days with precipitation	11	11	14	10	5
Number of days with snow	6	8	9	5	2
Snow on ground at end of month, in	None	None	0.5	Trace	None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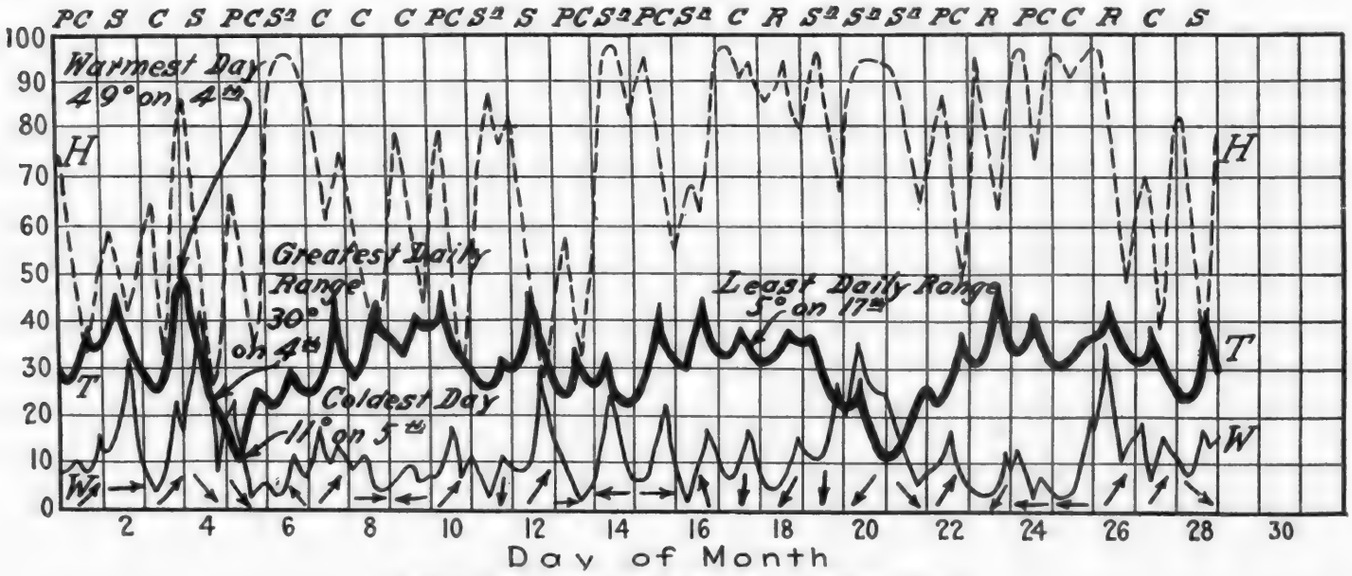
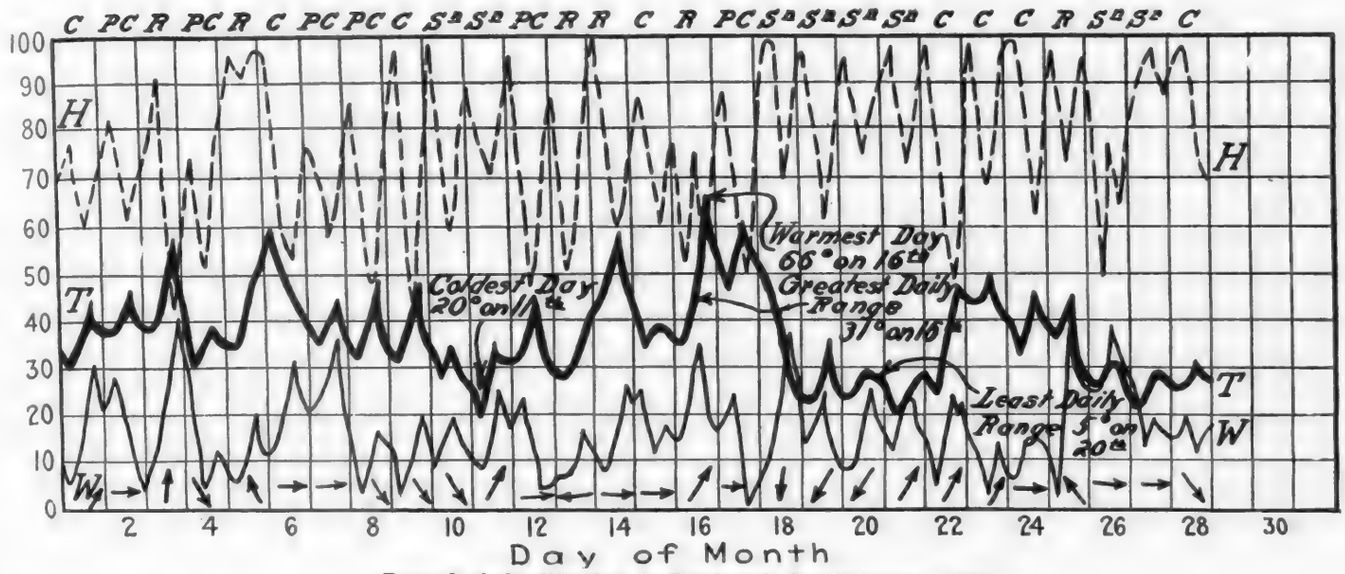
Greatest Daily Range 26° on the 4th
Warmest Day 56° on the 24th
Coldest Day 22° on the 21st
Least Daily Range 4° on the 20th
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

Record of the Weather in New York for February, 1927
(Hourly Observations of the Relative Humidity Plotted on this Chart)



Record of the Weather in Boston for February, 1927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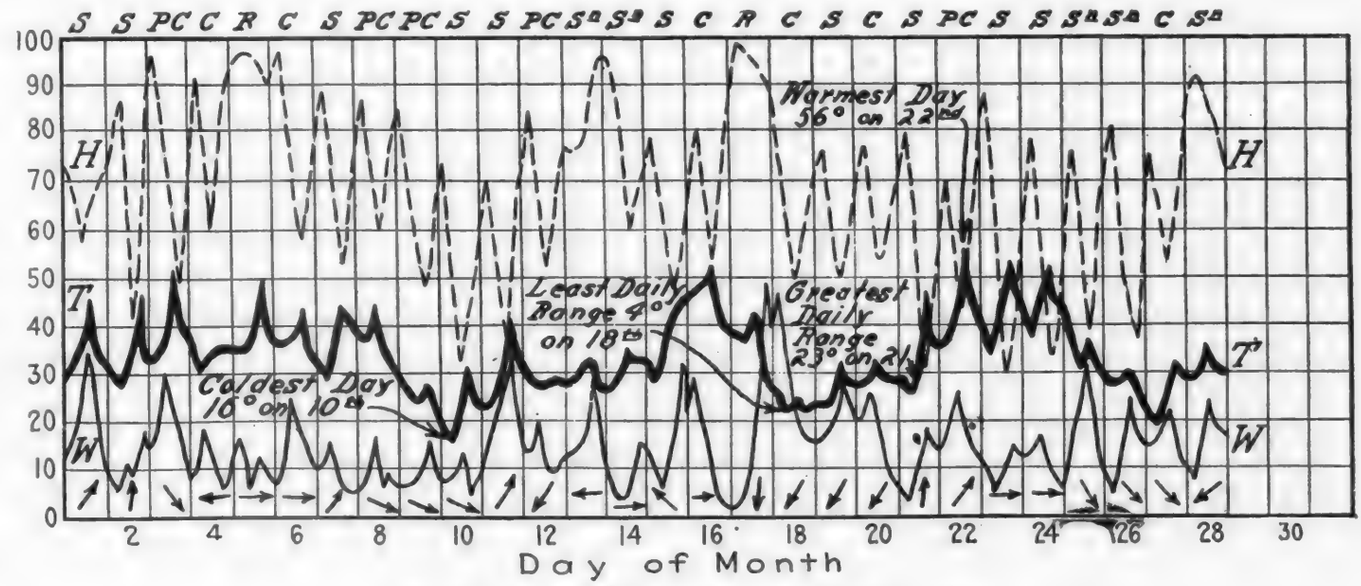
Warmest Day 66° on 16th
Coldest Day 20° on 1st
Greatest Daily Range 31° on 16th
Least Daily Range 5° on 20th
Day of Month

Record of the Weather in Pittsburgh for February, 1927


S S PC C R C S PC PC S S PC S S S C R C S C S PC S S S S C S
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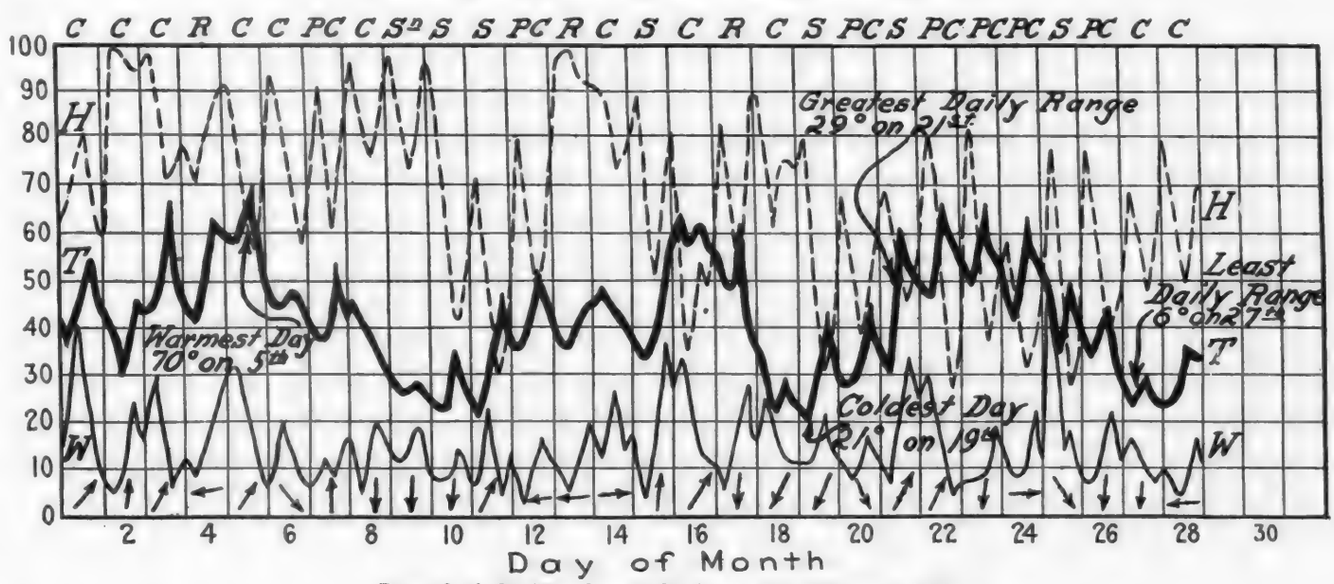
Warmest Day 56° on 22nd
Least Daily Range 4° on 18th
Greatest Daily Range 23° on 21st
Coldest Day 16° on 10th
Day of Month

Record of the Weather in Chicago for February, 1927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Greatest Daily Range 29° on 21st
Warmest Day 70° on 5th
Least Daily Range 16° on 27th
Coldest Day 12° on 19th
Day of Month

Record of the Weather in St. Louis for February, 1927

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperatures in degrees F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M.
S—Clear, PC—partly cloudy, C—Cloudy, R—rain, Sn—snow. Arrows fly with prevailing directions of wind.

American Oil Burner Association

Program of Oil Burner Convention

THE advance information makes certain that the fourth annual convention and exposition of the American Oil Burner Association, will in all regard outstrip its predecessors.

The convention will be held at the Hotel Statler, Buffalo, New York, April 5, 6 and 7, and the exhibit that has always been an important and vital part of these conventions, will be held in the Broadway Auditorium.

The program is unusually well-balanced, and the speakers are all men of national repute. Their remarks in the aggregate should present an accurate picture of the various phases of the industry as it stands today. A number of important manufacturers has been added to the membership of the association, since the last annual meeting. It is anticipated that the registration will approximate 1500.

The program follows:

TUESDAY, APRIL 5

8:00—Registration in the ballroom foyer at Hotel Statler.

8:30—Meeting of Board of Directors at breakfast.

9:00—Opening of Exhibit Hall at the Broadway Auditorium.

11:00—Meeting of subscribing members of the sales Stimulating Campaign—subscribers only—Parlor.*

1:00—Exhibit Hall closed.

1:30—General Meeting in the ballroom. Opening remarks by President Lionel L. Jacobs.

2:00—"Relation of Oil Fuel to Oil Heating," by Frank Howard, president, Standard Development Company.

2:40—"The Industry's Merchandising Needs," by M. J. Hammers, president, American NoKol Company.

3:20—"Co-operation of Manufacturers and Dealers from the Manufacturers' Standpoint," by M. H. Braden, vice-president, Nu-Way Corporation.

4:00—"Co-operation of Dealers and Manufacturers from the Dealer's Standpoint," by M. E. Simpson, vice-president, Automatic Oil Burner Corporation.

5:00—Annual business meeting of the association—open to members only.

At the Broadway Auditorium:

7:00—This night will be *"Buffalo Night"* in the Exhibit Halls. Architects, building contractors, engineers, industrial plant executives, and home owners will be invited to visit the exhibit halls and inspect the burners and equipment exhibited. Admission will be by card, mailed to those invited, by the Niagara Frontier Oil Burner Dealers Association.

At the Hotel Statler—Ball Room:

The main theme for discussion at the evening session will be "Advertising and Selling the Oil Burner Idea."

7:00—Radio address on oil burning by Edward P. Bailey, president, National Airoil Burner Corporation, broadcasting over station WGR, Hotel Statler.

7:30—"What the Sales Stimulating Campaign has Accomplished," by Leod D. Becker, executive secretary of the Association.

8:00—"Plans for the 1927-28 Sales Stimulating Campaign," by J. J. O'Donnell, sales manager, William Green Corporation.

8:30—"The Balance Sheet Value of Association Membership," by Edwin M. Fleischmann, president, May Oil Burner Corporation.

9:00—"What an Association Should Do for the Dealer," by Oliver D. Ward, of W. W. Ward & Sons.

9:30—Award of membership campaign prizes.

10:00—"Buffalo Night" entertainment. The Niagara Frontier Oil Burner Dealers Association will act as hosts at a special entertainment in the ballroom, to all out-of-town visitors, including the wives and families of those attending.

WEDNESDAY, APRIL 6

9:00—Exhibit hall open.

9:30—The American Radiator Company extends an invitation to visit its Institute of Thermal Research.

10:00—Meeting of Board of Directors in Parlor.*

1:15—Assembly at Hotel Statler for taking of the official convention photograph.

Manufacturers' Session—The main theme of discussion will center around the general subject of "Engineering and Production." (Fillmore Room.)

1:30—Opening remarks by Chairman J. C. Johnson, president, S. T. Johnson Company.

2:00—"Co-ordination of Research with Production," by James L. Breese, Jr., president, Breese Engineering Corporation

2:40—"What Practical Improvements in Burner Design May be Expected in the Next Two Years," by Franklin Hardinge, president Hardinge Bros., Inc.

3:20—"Seize Your Opportunity," by R. D. Marshall, Williams Oil-o-Matic Heating Corporation.

4:00—"Making Money in the Oil-Burner Industry," by Lawrence L. Smith, vice-president and general manager, Williams Oil-o-Matic Heating Corporation.

Dealers' Session—General topic: "Organization and Management."

1:30—Opening remarks by Chairman R. S. Bohn, president, Preferred Utilities Mfg. Corporation.

2:00—"The Fundamental Principles of a Successful Oil Burner Business and Oil Burner Dealership," by Wm. J. Foley, president, Wm. J. Foley Company.

2:40—"Why Sales and Service Men Fail," by F. H. Dickison, president, Dixol Service Company.

3:20—"How the Dealer can Make Money," by Homer R. Linn, engineer, American Radiator Company.

4:00—"Putting a Standard Accounting System to Work," by Albert Aber, president, Albert Aber & Company.

7:00—Annual banquet in ballroom. "Oil Burners," by Ernest H. Peabody, president, Peabody Enineering Corporation. Following the banquet and addresses, there will be dancing.

*To be announced on bulletin board of the Hotel Statler.

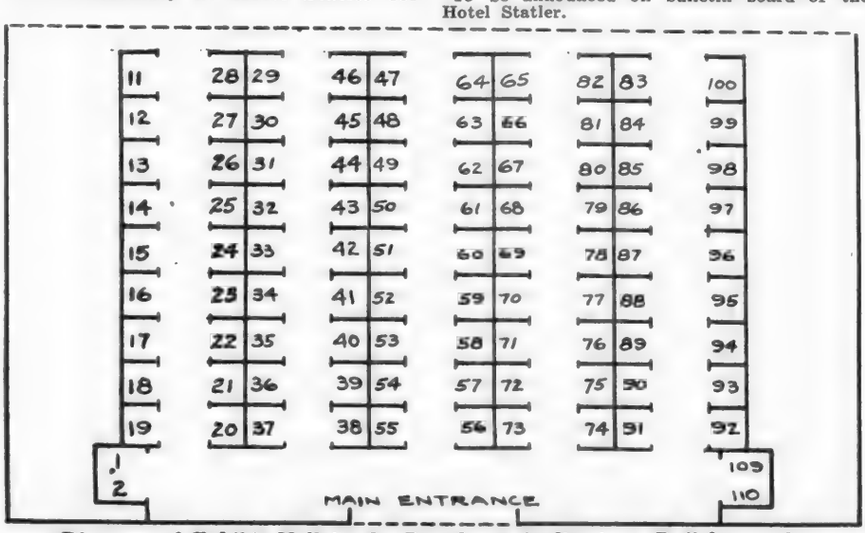


Diagram of Exhibit Hall in the Broadway Auditorium, Buffalo, at the American Oil Burner Association Convention

THURSDAY, APRIL 7

9:00—Exhibit hall open.

10:00—Meeting of the Board of Governors in Parlor.*

Manufacturers' Session, Fillmore Room—Main Topic: "Sales and Service."

1:30—Opening remarks by Chairman Walter F. Tant, president, Silent Automatic Corporation.

2:00—"Marketing Only Through Branches," by H. Finnie, general manager, The Timken-Detroit Company.

2:40—"Organizing for Service," by B. K. Eaton, general sales manager, Winslow Boiler & Engineering Company.

3:20—"Full Payment from Oil-Burner Sales Within Thirty Days," by E. R. Campbell, Silent Automatic Corporation.

4:00—"How to Budget Oil Burner Advertising," by Ralph S. Beale, sales manager, Electrol, Inc.

Dealers' Session—Ballroom.

1:30—Opening remarks by W. J. Harter, manager, Buffalo Automatic Heat Corporation.

2:00—"What Your Prospect Thinks about Oil Burners," by Luther McG. Moyer, vice-president, Beatty Sales Company.

2:40—"Organizing a Sales Force," by John W. Scott, president, Buckley & Scott, Inc.

3:20—"What Mechanical Refrigeration Offers the Oil Burner Dealer," by Lewis Lipman, General Necessities Corporation.

4:00—"Organizing the Dealer for Profit," by Dale O. Miller, secretary and treasurer, Mechanical Heat and Cold, Inc.

On Thursday evening an informal farewell entertainment will be provided by the Niagara Frontier Oil Burner Dealers Association.

*To be announced on bulletin board of the Hotel Statler.

BOOTH	EXHIBITOR	EXHIBITS
1-2	Absolute Contactor Co., Elkhart, Ind.	Controls
11	Chrobaltic Tool Co., Detroit, Mich.	Heat-resisting alloys
13-14	Webster Electric Co., Racine, Wis.	Electrical Equipment
17-18	W. B. Wilde Co., Peoria, Ill.	Oil burners
19	Northern Mfg. Co., Minneapolis, Minn.	Oil burners
20	Superoil Heator Co., Hartford, Conn.	Oil burners
23	Ballard Oil Equipment Co., Boston, Mass.	Oil burners
24	Ideal Oil Saver Co., Chicago, Ill.	Baffle plates
25	Williams Oil-O-Matic Corp., Bloomington, Ill.	Oil burners
27	Patrol Valve Co., Cleveland, O.	Equipment
28	Gulf Oil Burner Co., Philadelphia, Pa.	Oil burners
29	Dongan Electric Co., Detroit, Mich.	Electrical equipment
30	Tuthill Pump Co., Chicago, Ill.	Pumps
31-32	Bryan Steam Corp., Peru, Ind.	Boilers
33	Wagner Electric Co., St. Louis, Mo.	Electrical equipment
34	W. J. Tierney Co., Rochester, N. Y.	Pumps
35-36	American Radiator Co., New York	Boilers
37	American Blower Co., Detroit, Mich.	Blowers
38	Beckwith Co., Dowagiac, Mich.	Oil burners
39	Titeflex Metal Hose Co., Newark, N. J.	Metal hose
40	Janette Mfg. Co., Chicago, Ill.	Electrical equipment
41-42	Combustion Fuel Oil Burner Co., Milwaukee, Wis.	Oil burners
43-44	Hardinge Bros. Chicago, Ill.	Oil burners
45	Moore & Kling, Inc., Boston, Mass.	Equipment
46-47	May Oil Burner Co, Baltimore, Md.	Oil burners
48-49	W. S. Ray Mfg. Co., Los Angles, Calif.	Oil burners
50-51	Nu-Way Corp., Rock Island, Ill.	Oil burners
52	Automatic Home Heating Co., Pueblo, Colo.	Oil burners
53-54-55	Minneapolis Heat Regulator Co., Minneapolis, Minn.	Controls
56-73	Federal Gauge Co., Chicago, Ill.	Controls
57-58	Fuel Oil for Heat and Power, New York.	Magazines
60	Preferred Utilities Mfg. Corp., New York.	Equipment
61	Silent Automatic Corp., Detroit, Mich.	Oil burners
62-63	Electrol Inc., of Mo., St. Louis, Mo.	Oil burners
64	Liquidometer Co., Inc., Long Island City, N. Y.	Gauges
65-66	Cook Electric Co., Chicago, Ill.	Pumps
67	Sword & Kimber Co., Philadelphia, Pa.	Oil burners
68	M. George Tigar, Floral Park, N. J.	Oil burners
69	American Machine & Foundry Co., Brooklyn, N. Y.	Pumps
70	Jefferson Electric Co., Chicago, Ill.	Electrical equipment
71-72	Associated Sales Campaign, New York.	Literature
74-75-76	Honeywell Heating Specialties, Wabash, Ind.	Controls
77	Monitor Furnace Co., Cincinnati, O.	Oil burners
78	McDonnell & Miller, Chicago, Ill.	Equipment
79	American Schaeffer & Budenberg Corp., Brooklyn, N. Y.	Equipment
80	Century Electric Co., St. Louis, Mo.	Electrical equipment
82	Morgan Gage Co., Rockaway, N. J.	Gauges
83	K-W Ignition Corp., Cleveland, O.	Electrical equipment
84	Bunting Iron Works, Berkeley, Calif.	Oil burners
85	Economy Heat Unit Co., Minneapolis, Minn.	Oil burners
86	Consolidated Boiler Co., Benton Harbor, Mich.	Boilers
87	Petroleum Heat & Power Co., Stamford, Conn.	Oil burners
88-89	Wayne Co., Fort Wayne, Ind.	Oil burners
90-91	Aetna Oil Burner Corp., Providence, R. I.	Oil burner
92-110	S. T. Johnson Co., Oakland, Calif.	Oil burners
93	The Heating & Ventilating Magazine, New York.	Magazines
94	Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.	Electrical equipment
95	Frank A. Holby Corp., New York.	Oil burners
96	Lawrence May Oil Burner Co., Flushing, N. Y.	Oil burners
97	Cooper-Hewitt Electric Co., Hoboken, N. J.	Electrical equipment
98-99	General Electric Co., Schenectady, N. Y.	Electrical equipment
100	Fluid Heat Corp., Baltimore, Md.	Oil burners
109	Teesdale Mfg. Co., Grand Rapids, Mich.	Pumps

N. F. P. A. Formulates Revisions to Oil-Burning Regulations

AT a meeting held in New York, on March 3, the Committee on Flammable Liquids of the National Fire Protection Association and the National Board of Fire Underwriters discussed at length a number of important matters connected with the revisions of the 1925 Regulations for Oil-Burning Equipment that have been in force for the last two years. The subjects under discussion previously had been thoroughly thrashed out by mail and by sub-committee meetings so that the function of this committee was merely to bring the matter to a focus.

It was the attitude of the committee that even after the careful thought that has been given the subject, the regulations should not officially be modified until every possible angle had been considered by every individual or interest likely to contribute constructive thought to the problem.

The following suggested revisions of the Regulations for Oil Burning Equipment (Edition 1925) therefore are promulgated by the association for such comment, suggestion and criticism as may be offered. The references of course are to the pages, rules and paragraphs as printed in the pamphlet issued by the National Fire Protection Association.

SUGGESTED REVISIONS of the REGULATIONS FOR OIL-BURNING EQUIPMENT

(Edition 1925)

Omit the word "construction" from titles on cover and on pages 1, 3, and 19.

Immediately preceding the regulations for the Installation of Domestic Oil-Burning Equipments (between pages 18 and 19) create a new division to be entitled: "Regulations for the Installation of Oil-Burning Equipments in Apartment Houses, Public and Similar Buildings where a Competent Attendant is not constantly on duty in the Boiler Room." The requirement for this new division shall read as follows:

"In hotels, apartment houses, office buildings and similar occupancies, where a competent attendant is not required to be constantly on duty in the boiler room, the oil-burning equipment shall be provided with suitable automatic safeguards to prevent abnormal discharge of oil at the burner".

On page 5 change Rule 4 (b) as follows:

Omit last sentence of the second paragraph and add the following as a Note:

"Note: *Owing to the increasing practice of filling storage tanks by means of power pumps mounted on truck tanks and delivering the oil through a tight connection to the filling pipe, there is grave possibility of damage to the storage tank and a hazardous discharge of oil. Underground storage tanks are not designed to withstand the pressures to which they may be subjected by power filling, particularly where the vent pipe is smaller than the filling pipe. Where pump filling is permitted or anticipated, it is preferable to increase the size of the vent pipe, and in all cases to use special precautions to avoid overfilling the storage tank.*"

On page 6, Rule 8, entitled "Setting of Tanks," revise the first paragraph of (a) to read as follows, the revision being in italics:

"(a) Tanks shall be buried underground, with top of tank not less than 2 ft. below surface of the ground, and below the level of any piping to which the tanks may be connected, except that in lieu of the 2 ft. cover tank may be buried under 12 in. of earth and *a slab of reinforced concrete or equivalent construction, in no case less than 5 in. in thickness and capable of sustaining a load of 250 lbs. per sq. ft.; slab shall be set on a firm well tamped earth foundation and shall extend at least 1 ft. beyond the outline of the tank in all directions.* Tanks shall be securely anchored or weighted in place to prevent floating where special conditions make it necessary."

On page 10, change Rule 14 (d) as follows:

"14 (d). Steel tanks of over 275 gal. capacity shall be placed in an enclosure of dimensions 6 in. greater on all sides than the outside dimensions of the tank. The walls and floor of the enclosure shall be constructed of reinforced concrete not less than 8 in. in thickness or of 12 in. of masonry. The walls shall be carried up to a height not less than 1 ft. above the tank and the space between tank and the wall and roof of the enclosure shall be completely filled with sand or well tamped earth. The enclosure shall be roofed over with reinforced concrete or equivalent construction, in no case less than 5 in. in thickness and capable of sustaining a load of 250 lbs. per sq. ft."

"Note: No open spaces immmediately around tanks shall be permitted, as such spaces may collect explosive mixtures of vapor and air."

On page 11 amend table on underground storage by striking out item (g) and add a new paragraph reading as follows:

"When within 10 ft. of any building and the top of the tank is above the lowest floor, basement, cellar or pit of the building, the limit of individual tank capacity shall be restricted to 50,000 gal."

On page 17 change section VII, Pumping Systems, as follows:

"Section VII *OIL SUPPLY*

37 (a) *Except as provided in following paragraphs, oil shall be pumped from tank to burners.*

(b) *Gravity and pressure feed may be used to the same extent as permitted in the Regulations for Domestic Oil-Burning Equipments if similarly safeguarded.*"

On page 19 omit second paragraph of preface and substitute the following:

"*Oil-burning systems of this class are intended principally for heating dwellings, but may be permitted, by authorities having jurisdiction, for use in industrial plants and for heating apartment houses and the like.*"

On page 20, Rule 1, Location of Tanks, revise paragraph (b) to read as follows, the revision being in italics:

"(b) When located inside building, the aggregate capacity of the tanks used in connection with the system shall not exceed 275 gal., *unless enclosed as required by Rule 14 of the preceding Regulations for Oil-Burning Equipments, other than Domestic (p. 10).*"

On page 21 change Note to Rule 2 (b) to read:

"Tanks for systems under pressure shall be designed for *at least six* times the maximum working pressure, and tested to twice the maximum working pressure."

On page 21 add the following Note to Rule 3 (c).

"Note: *Owing to the increasing practice of filling storage tanks by means of power pumps mounted on truck tanks and delivering the oil through a tight connection to the filling pipe, there is grave possibility of damage to the storage tank and a hazardous discharge of oil. Underground storage tanks are not designed to withstand the pressures to which they may be subjected by power filling, particularly where the vent pipe is smaller than the filling pipe. Where pump filling is permitted or anticipated, it is preferable to increase the size of the vent pipe, and in all cases to use special precautions to avoid overfilling the storage tank.*"

On page 22, Rule 7, entitled "Setting of Tanks," revise the first paragraph of (a) to read as follows, the revision being in italics:

"(a) Tanks shall be buried underground, with top of tank not less than 2 ft. below surface of the ground, and below the level of any piping to which the tanks may be connected, except that in lieu of the 2 ft. cover tank may be buried under 12 in. of earth and *a slab of reinforced concrete or equivalent construction, in no case less than 5 in. in thickness and capable of sustaining a load of 250 lbs. per sq. ft.; slab shall be set on a firm well tamped earth foundation and shall extend at least 1 ft. beyond the outline of the tank in all directions.* Tanks shall be securely anchored or weighted in place to prevent floating where special conditions make it necessary."

On page 23 change Rule 7 (d) by adding the word "Unenclosed" at the beginning of the paragraph.

On page 24 revise Rule 10 (b) by omitting "preferably" at the end of the second line.

On page 24 change 11 (a) to read as follows, the revision being in italics:

"(a) Standard, full weight, wrought iron, steel, or brass pipe, with substantial fittings *or approved brass or copper tubing with* approved fittings shall be used, and shall be carefully protected against mechanical injury in a manner satisfactory to authorities having jurisdiction. In all piping systems proper allowance shall be made for expansion and contraction, jarring, and vibration."

"All piping shall be separated from electric wires not enclosed in approved conduit, raceways, and armored cable, by some continuous and firmly fixed non-conductor creating a permanent separation as provided in the "National Electrical Code."

On page 25, Rule 11 (a) omit the last sentence reading:

"The use of tubing of any kind is prohibited."

On page 25 add a new paragraph (b) reading:

"(b) *Approved brass or copper tubing, where permitted by authorities having jurisdiction, shall have a wall thickness of not less than 1/16 in. for small sizes and correspondingly heavier where necessary.*

"*Flexible metallic tubing employed for the purpose of reducing the effects of jarring and vibration shall be of approved type and shall be installed strictly in accordance with the limitations of its approval.*"

Change present (b) to (g), (c) to (h), and (b, c, d, e, f, g) to (c, d, e, f, g, h).

On page 26 change Rule 13 to 13 (a) and add the following:

"(b) In territories having an electrical power supply subject to extreme fluctuations, it is recommended that electrically-operated burners be installed only in connection with an approved low voltage release, capable of opening the line circuit to the burner when the voltage fluctuates more than 18% from normal."

On page 26 change rule 14, Burners, to read:

"Burners shall be of approved type provided with suitable automatic safeguards to prevent abnormal discharge of oil."

On page 26, omit Rule 15, Pilot Light.

On page 26 change Rule 16 to Rule 15.

On page 27 change present Rule 16 (e) to read:

"Where automatic operation is provided, the installation shall be equipped with approved limiting devices to prevent overheated hot-air furnace ducts, excessive water temperatures, or abnormal steam pressure. It is recommended that in steam, vapor, or vapor vacuum systems, approved means be provided to guard against firing into a dry boiler or one in which the water level is dangerously low. Such means should be arranged to require manual resetting or operation should not be permitted until the safe water level is restored."

Training Steam Fitters to Sell Heating Appliances

MORE business—more profits—less competition—and greater all-around satisfaction—will follow when the heating contractor realizes that his steam fitters have a wide open invitation to sell more heating appliances every time they are sent into a home to make an installation, repair or inspection of a heating plant. They have an excellent opportunity to increase sales on a non-competitive and more profitable basis, if they are trained to sell, and report sales opportunities.

Manufacturers of electrical equipment, radios, washing machines, vacuum cleaners, and many others, who are fighting for the buyer's dollar, would give almost anything for the opportunity you have to get your salesmen into the home, where they have a chance to demonstrate and sell your products.

This unexcelled sales opportunity is very largely neglected by the heating contractor because he has not trained his steam fitter to sell as well as install. Selling is the most important feature of business and one of the most neglected by the average heating contractor. When the act of selling is carefully analyzed, it is nothing more than asking people to buy and showing them why it is to their benefit to buy. The steam fitter comes most frequently in contact with the prospective, or potential buyer, of heating fixtures and has the best opportunity to interest and to sell the home owner on improved or additional heating equipment.

A buyer of air valves frequently is a prospect for pipe covering and an automatic heat regulator; the buyer of a heat regulator may be a good prospect for air valves, pipe covering, radiator shields, furnace grate, additional radiators or an entire new system. Unless the steam fitter is instructed to look for and report sales opportunities and makes and effort to interest the house-owner in additional or improved equipment, a great deal of easily-secured business is lost.

The National Trade Extension Bureau has prepared a special form for the steam fitter to use in reporting the condition of heating system and the opportunity for sale of additional equipment.

Heating plants in most parts of the country will soon be shut down for the summer and now is the time for heating contractors to call property owners' attention to the economy in having pipes covered; the convenience of heat regulation; the need for air valves, radiator shields, etc. A special letter mailed to property-owners, calling attention to the benefit of inspection and repair service, will develop many sales opportunities while putting the plant into first-class shape for fall use. The National Trade Extension Bureau will gladly supply sales letters for this purpose, upon request, without charge.

The purchasing value of the dollar, as measured by living costs for the American wage earner or other people of moderate means, has fluctuated little more than 5%, or only about "a nickel" in case of a dollar purchase, during the past five years, according to the National Industrial Conference Board, 247 Park Ave., New York. The dollar now is worth, on the basis of living costs, just about 60 cents as compared with the pre-war (1914) dollar, and having fluctuated less than five cents either way from this value, since 1921, may be considered as having become stabilized at this level, as contrasted with the severe fluctuations of the first few years after the war.

Average living costs as computed by the Conference Board during the year 1926 were slightly (1.8%) lower than in 1925, but in January, 1927, were still 66% higher than in 1914, just before the war. Average weekly wage earnings at the beginning of the current year, however, were 116% higher than or more than double that which they had been in 1914, leaving the wage earner 28% better off than he had been before the war with respect to the purchasing power of his weekly pay.

The Business of Contracting

A Discussion of the Application of Common Sense and System to Contracting Work

THE average heating contractor starts from a very small beginning, and if he is both capable and fortunate arrives at a very creditable accomplishment. His road between these two extremes, however, is often hard and beset with many difficulties. Inexperience at first, unwise contracts, unfair competition, defective work done by employees, unreasonable customers, bad bills, lost tools, stolen material,—all fall back on Mr. Contractor and, in nine cases out of ten, are paid for out of his own pocket.

One of the greatest and most constant difficulties experienced by many contractors is in what constitutes the business end of the business—if such an expression is permissible; that is to say, in the running of the business. There are a great many of us who are quite capable of carrying on with a considerable degree of success as long as our accounts can be kept in our hat, but when the business has grown to between $50,000 and $100,000 per annum, the hat, even if made into a sombrero, is quite inadequate.

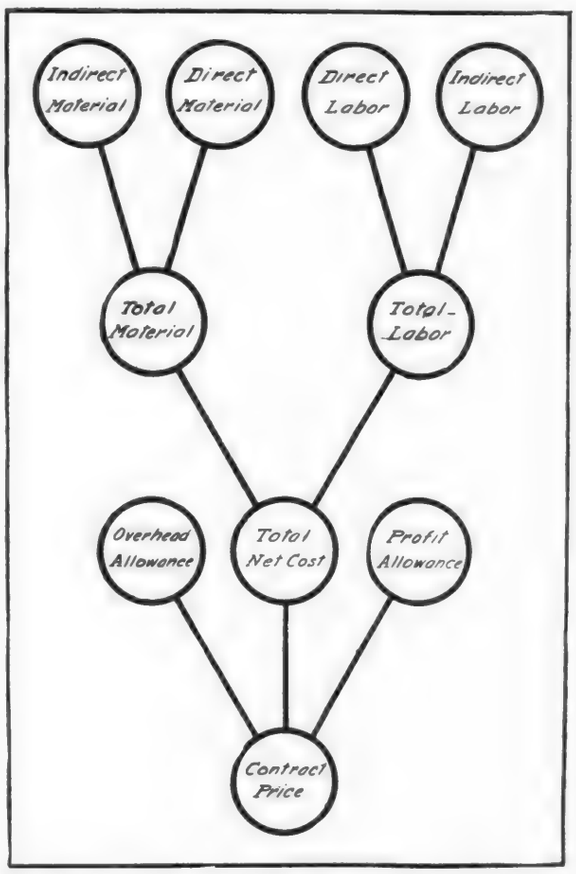


Fig. 1. Diagram Showing How Isolated Cost Factors Unite to Produce a Final Contract Price

NEED OF SYSTEM REALIZED

Some sort of a system must be used as the business grows and Mr. Contractor often asks advice from Mr. Jones the grocer, or Mr. Brown the butcher, or any other friend he may have, in order to find out how others were solving their accounting problems. After a little experiment Mr. Contractor finds, to his sorrow, that the schemes and methods used by his friends are not applicable to his difficulties because *he* is running an entirely *different* kind of a business. Not necessarily in regard to the variation in material sold, but in consequence of the fact that Mr. Contractor also sells a commodity which the merchant may not merchandise—viz. *labor*.

This is the fundamental difference between contracting and all other mercantile pursuits—the labor element included with the future delivery of material and labor, all at a stipulated price as set forth in the contract. In addition, oftentimes Mr. Contractor has to even put up a bond to guarantee fulfillment. Consequently a contract may be a liability or an asset, depending on how much more or how much less Mr. Contractor is going to receive for doing the job than it is going to cost him to do it.

If a job is going to cost $12,000 to carry out and only $11,000 is going to be received for the work, the contractor is going to lose money and that particular contract is a liability. But if the contractor is going to receive $15,000 for the job, then the contract is an asset.

NEED OF ACCURATE ESTIMATES

Yet here, again, enters another factor. How does Mr. Contractor *know* a job is going to cost him just $12,000? In fact, it undoubtedly will not cost him exactly $12,000; it probably will be either over or under this figure; but how much over? Or, how much under? Thus the necessity of accurate estimating readily can be seen. Carelessness in estimating can put a contractor out of business about as quickly as any other factor.

Now the only way a contractor can make accurate estimates for his own particular locality and under his own peculiar working conditions is for him to provide himself with *a record of what previous jobs of a similar nature have cost*. If his costs are kept accurately they should give him a very good line on his estimating, when used with proper allowances for the difference between jobs.

And cost-keeping, to be of any use, must be done accurately, for incorrect costs are worse than no costs at all. An incorrect cost is the finest way in the world to fool yourself into thinking you can install a boiler or a radiator for so much, when, as a matter of fact, the real cost may be 25% more.

ITEMS INVOLVED IN TRUE COSTS

The true cost consists of five items; viz.: the direct labor, direct material, indirect labor, indirect material and overhead.

Direct labor is labor applied directly to the installation of the work and consists principally of the mechanics' time expended on the work.

Direct material is the material used directly on the work and consists principally of the pipe, fittings, radiators, boilers, valves, pipe covering, and similar items *less the amount returned* at the completion of the work.

Indirect labor is labor expended on account of the job but not chargeable directly to the work. Under this head may be included such items as superintendence, stock keeper, blacksmith time and similar items of work where the labor is not entirely for any one job but is for all the jobs being carried on.

Indirect material is material used on all the jobs and not chargeable to any job in particular, such as waste, cutting oil, candles, red lead, and similar items.

Overhead is the most mysterious of all and seems the hardest for the average contractor to grasp. It includes the expenses necessary and incidental to carrying on a contracting business and embraces a multitude of items. Office rent, and cost of submitting both accepted and unaccepted proposals, taxes, telephone, postage, heat and light in the office, cost of landing business, entertainment and a multitude of other minor expenses—all are overhead.

These five items must be accurately determined if a dependable cost is to be secured or a correct estimate made. It is not quite so difficult as it sounds—luckily for all contractors.

DIRECT COST OF MATERIAL AND LABOR

In the first place, the direct cost of the material may be obtained very closely

—and is usually done quite accurately, even by unsystematic contractors—by taking off the list of material required for the job and pricing it up according to prevailing prices. This is really one of the first things that a contractor learns to do.

Next, the direct labor item is not quite so easily or accurately determined but a contractor can usually tell pretty closely what the mechanic's time on a job should amount to. He may estimate on each pipe line and each radiator or piece of apparatus or—by his previous experience—he may be able to tell pretty closely what his time is going to total.

Another good method to check by is to look up previous records and determine the labor per radiator, or per fixture, based on the total number of radiators or fixtures on the job. This unit of labor per radiator, or per unit, then can be multiplied by the number of radiators or units and the check being made should come fairly close to the direct labor figures already estimated. If it does not, then it is time to look somewhere for errors.

INDIRECT COST OF MATERIAL AND LABOR

The matter of indirect material is not as easily handled. For this reason all material, as far as possible, should be made direct material. It has been found by experience that the minor items, such as are included in this heading, can be handled best and most easily by reducing them to a percentage form and simply adding this per cent. to the direct material.

For instance, if it is found that for the past year the items being charged to "indirect material" amount to 5% of the amount of direct material cost, then all it is necessary to do is to add 5% to the cost of the "direct material" to get a total material cost.

The matter of indirect labor is treated exactly the same and a per cent. is developed, based on the "direct labor." If this percentage figures out at, say, 10%, then 10% is added to the "direct labor" to obtain the "total labor" chargeable to the job.

OVERHEAD

Overhead should include everything paid out in the business which is not included in the other four items of direct and indirect labor and material. This is also worked out in a percentage form and is based on the proportion that the overhead bears to the "total labor," plus the "total material."

As an example, suppose a contracting company, during the past year, has bought total materials aggregating $40,000 (including both direct and indirect classifications) and has paid out in labor (including both direct and indirect) the sum of $15,000 and that all other expenditures (overhead) amount to $20,000. Then the total of labor and material is $40,000, plus $15,000, or $65,000. The overhead of $20,000 divided by the $65,000 gives a percentage of approximately 31%.

This means that, for every dollar of labor and material (both direct and indirect) actually expended on the job, there has been an additional expenditure of $0.31 for office and incidental charges of carrying on the work.

When this 31% is added, the actual gross cost of any job is obtained.

Profit is then added to the gross cost and the contract price develops. A simple little example will do much to explain the working of this system.

EXAMPLE OF APPLICATION

Suppose a careful estimate of the material required for a certain piece of work comes to $100.00 and the mechanic's labor figures $75.00; these are set down as follows:

	Material	*Labor*
Direct	$100.00	$75.00
Indirect 10%	10.00	5% 3.75
Total	$110.00	$78.75
Total of labor and material $78.75 plus $110.00, or		$188.75
Overhead 31%		58.51
		$247.26
Profit 10%		24.73
Contract price		$371.99

In the next article ways and means of accurately determining the percentages to be used will be discussed.

Legal Decisions

Placing Ventilating Sash in Building Sustains Lien—Heating Plant Held a Fixture

In an action to foreclose a lien for labor and materials, furnished in the construction of a greenhouse, the important question was whether the lien was filed in time. The plaintiff alleged the last day of furnishing labor and materials was March 4, 1922. The building was substantially completed in November, 1921, when the owner, who was in possession of the land under a conditional purchase contract, occupied it. A small amount of work was done by plaintiff on January 15, 1922. Defendant denied any labor materials were furnished in March, 1922. Plaintiff testified that on March 14, he placed a ventilating sash in the greenhouse to the value of $3; that the original plan contemplated four such sashes; that three were put in during the main construction; that the space for the fourth was boarded over prior to ceasing work in November; that to that extent the building was unfinished, and that the plaintiff knew he still had to complete this part of the work. The evidence on this feature of the case conflicted sharply. There being substantial testimony to uphold the trial court's finding for the plaintiff, it was not disturbed.

Mere lapse of time between the date work ceased in November, 1921, and March 14, 1922, while important, was not, the Montana Supreme Court holds, *Bartholomew* v. *James*, 246 Pac. 771, conclusive upon the question whether the item of March 14, 1922, constituted a part of a continuous open account between the parties. Whether the work and materials, commencing with the first item, and ending with that of March 14, 1922, were furnished under one contract—under a continuous open account—was held to be one of fact. The fact that the plaintiff, at various times, rendered the defendant statements of account did not, of itself, change the situation. The item of March 14, consisting of the ventilator sash, was held a bona fide one and, therefore, sufficient to sustain the lien. The item was contemplated in the original plan of the greenhouse. It was not a subterfuge for securing a lien.

There was installed in the greenhouse by some one, other than the plaintiff, a heating plant with many connecting pipes. This the trial court held to constitute a part of the building, essential for the purpose for which it was erected, and adjudged that the lien of the plaintiff extended to and covered the whole of the building, including its entire heating plant and water system. Defendant's counsel contended this adjudication of the trial court was erroneous, and asked:

"Is the heating plant a fixture within the meaning of the law, and subject to removal under the lien as a part of the building?"

This question the Supreme Court answered in the affirmative. "The testimony," the court said, "showed that the heating plant and steam pipes are a part of the building. The pipes lead from the furnace through the main part of the greenhouse, many running overhead, and also along grooves on each side of the passageway."

At the time of the action the contract, under which possession of the land was held, had been declared forfeited, and the action was against the original owner as well as the conditional purchaser. The latter's interest in the land was held to be equivalent to a leasehold, and Mont. Rev. Code 1921, §8343, applied. This statute provides that the forfeiture of a leasehold interest does not impair such liens. Plaintiff was, therefore, held entitled to a lien extending to the entire building, added to the owner's land by the conditional purchaser.

Grates for Burning Small-Sized Anthracite

Previous articles in this series are as follows:

1.—*Neemes, October*, 1926.
2.—*Johnson, November*, 1926.
3.—*Rath, November*, 1926.
4.—*Pyramid, December*, 1927.
5.—*Culm-Burn, December*, 1926.
6.—*Atlas, January*, 1927.
7.—*Spencer Heater, February*, 1927.
8.—*Grieve Grates, March*, 1927.

9. Tread-Kill

THE "Tread-Kill" combustion system, manufactured by the M. H. Treadwell Co., 140 Cedar St., New York, is unique in being practically automatic. In connection with its machined overlapping end-dumping grates, the system comprises multivane-type blowers to provide a positive delivery of air at the necessary pressure and volume. The fans are driven by direct-connected electric motors set on elevated concrete foundations on top of which is placed cork insulating board.

To provide for control, the motors may be stopped and started at any desired pressure from 1 oz. to 15 lbs., at any vacuum from 0" to 30" or at any temperature from 110° F. to 250° F., with automatic cut-out switch. With large motors, an across-the-line automatic magnetic starter is used in conjunction with the switch.

"Tread-Kill" Dumping Grate

In large heating plants and high-pressure systems, delivery of air to ashpits is controlled by hydraulic damper regulator in conjunction with ball-bearing damper in main air duct, thus delivering necessary amount of air required to carry the varying loads. Variable-speed motors are used in this class of work if direct current is supplied.

All duct work is constructed of heavy galvanized-iron, with the necessary butterfly dampers controlled by quadrants. The boilers may be cross-connected, if necessary.

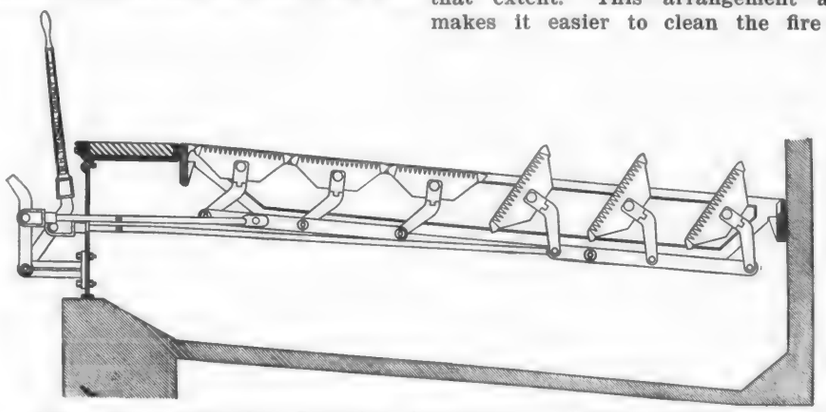
In the construction of the grates, staggered mesh air openings are uniformly and evenly distributed throughout the entire grate surface. They are made for various types of boilers with furnaces ranging from 17 in. wide by 34 in. deep up to 14 ft. 4 in. wide by 10 ft. deep.

Levers are provided for dumping the ashes into the ashpit where they may then be wet down with a hose.

Special automatic tools are used to machine the grates, not only to insure that the slots in the side webs of each grate are of precisely the same size, but also to insure a level grate surface, with no parts projecting into the fuel bed. Careful investigation, states the company, into the reason for regular grate bar renewals has shown the principal cause to be the fact that they are not uniformly level.

The grates are described as having an unusual percentage of free air space. To prevent the loss of fuel at the ends of the grate bars, the ends underlap and overlap each other and have air spaces the same in size as those in the grate bar body. These air spaces accurately match each other. The design also provides for expansion so that the ends will not project into the fuel bed. Openings in the dumping bar are made as small as ⅛-in. and pinhole openings are also supplied.

Another type of grate made by the company is the "Tread-Kill" self-locking shaking grate for handling both bituminous and domestic sizes of anthracite coal. It is built with any air space desired. Designed to be shaken both ways, forward and backward, the breaking of the clinker is simplified to that extent. This arrangement also makes it easier to clean the fire of ashes from front to rear where free-burning coal is used.

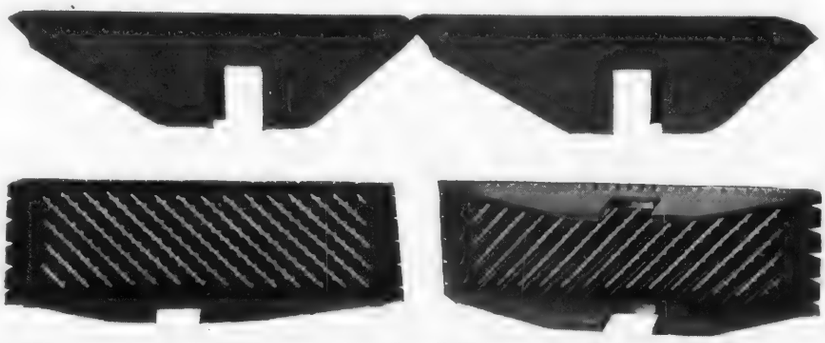


Short Section Tandem Dumping Arrangement of "Tread-Kill" Grate

Chicago's Building Exposition

Chicago's permanent building materials and equipment exposition, to be housed in the 23-story Builders' Building, which is nearing completion on double-decked Wacker Drive, will be opened to the public on May 1.

This exposition will give the prospective owner or builder of home, office building or industrial plant, in cooperation with an architect, the opportunity to make selections of materials from the basement plumbing to the cornice. Contractors will have the opportunity to see models of steam shovels or other equipment that will do the excavation on their projects, as well as to learn methods by which leaders in the construction field are carrying on their work, even during the coldest months of the year.



Overlapping End Dumping Bar Showing Rows of Staggered Air Spaces

General View of Exposition, Twelfth Regiment Armory

Second Annual Heating and Ventilating Exposition

WITH a limited number of exhibitors, the Second Annual Heating and Ventilating Exposition, held March 14-19, at the Twelfth Regiment Armory, Columbus Avenue and 61st Street, New York, demonstrated once more the possibilities of such a show. The exposition lacked the support of important manufacturing interests, as well as that of the American Society of Heating and Ventilating Engineers, due largely to a feeling that the number of such shows had reached the saturation point.

As was the case last year, the exposition demonstrated clearly that such a show, under proper auspices, could be made of immense value in promoting heating and ventilating as a separate and distinct industry, and already plans are on foot to continue the exposition, possibly in connection with the Power Show. However, what many consider a more desirable plan is to have the show retain its identity and be held possibly in conjunction with the annual meeting of the A.S.H. & V.E.

Exhibitor	*Address*	*Product*
Atlas Combustion Co.	New York	Thermo Grates for burning small-sized anthracite
American Machine & Foundry Co.	Brooklyn, N. Y.	Roller Rotary oil pumps
Anthracite Coal Service	Philadelphia, Pa.	Different sizes of anthracite coal from largest to smallest size
Consolidated Gas Co.	New York	Gas-fired boilers, heaters and refrigerators
Modine Mfg. Co.	Racine, Wis.	Modine unit heater
Metal Stamping Co.	Long Island City, N. Y.	Vulcan radiator cabinets
Sundstrand Engineering Co.	Rockford, Ill.	Sundstrand oil burner
Master Engineering Co.	New York	Master stoker
Wedge Mechanical House Heating Furnace Co.	Paoli, Pa.	Domestic stoker
State Burner Corp.	Brooklyn, N. Y.	In-the-Door oil burner and A. B. C. oil burner
E. B. Latham Co.	New York	Round Oak Summer Heat oil burner; also A. B. C. house fan
Rome Brass Radiator Co.	Rome, N. Y.	Brass radiators
Louis Bossert & Sons, Inc.	Brooklyn, N. Y.	Five-room house (actual size) with Heatrola heater, A. B. C. kitchen fan, Sokol refrigerator and Atwater-Kent radio
W. H. Johnson Co.	Indianapolis, Ind.	Johnson radiator shields and covers
Domestic Stoker Co.	New York	Electric Furnace-Man in operation
Estate Stove Co.	New York	Gas ranges and the Heatrola
Baker Oil Burner Co.	New York	Baker oil burner
American Temperature Indicating Co.	Toledo, O.	The Caliscope and long-distance reading thermometers
Typhoon Fan Co.	New York	Typhoon fans
Iron Fireman Domestic Stoker Corp.	New York	Iron Fireman automatic stoker and Iron Fireman Junior stoker
Bittner Petersen Co.	New York	Thickedger electric sheet-metal machine
Gill Oil Burner Co.	Chicago, Ill.	Gill oil burners
Majestic Cabinet Works	New York	Radiator enclosure cabinets
A. B. C. Boiler Corp.	Poughkeepsie, N. Y.	Abco house-heating boilers
Fitzgibbons Boiler Co.	New York	Fitzgibbons steel boilers
Hardinge Brothers, Inc.	Chicago, Ill.	Hardinge oil burners
Nodriaire Co.	Plainfield, N. J.	Nodriaire radiator humidifying devices
Pyramid Iron Products Co.	New York	Pyramid grates
Kilsoot Chemical Co.	New York	Kilsoot compounds for cleaning chimneys
Heating and Ventilating Magazine Co.	New York	THE HEATING AND VENTILATING MAGAZINE, books and data sheets
Gifford Heat Control Systems, Inc.	New York	Gifford heat control systems
Economy Heat Unit Co.	Minneapolis, Minn.	In-the-Door oil burner

A. S. H. & V. E. Standard Method for Testing Radiators

One of the important actions taken at the recent annual meeting of the A.S.H. & V.E., in St. Louis last January, was the adoption of a standard method for testing direct radiators proposed by the Technical Advisory Committee on Radiation, of which R. V. Frost was chairman. Following is the method in full:

CONDENSATION METHOD FOR TESTING DIRECT RADIATORS

Foreword: The ultimate aim of the committee is the preparation of a code for testing radiators to determine the useful heating effect; but to provide a standard method of test until the necessary research is completed, the following method which will be known as the Condensation Method, is proposed:

Test Room—The test room shall be 12 ft. by 15 ft. in floor area and have a ceiling height of 9 ft., with an allowable tolerance of plus or minus 10% in any dimension. The walls and ceiling shall have a smooth, close surface and be painted flat gray in color. A window not larger than 16 sq. ft. will be permitted in the test room, but the window shall be shielded from direct rays from the radiator.

The test room shall be set up in a larger room which shall be maintained with a uniform temperature at a level 5 ft. above test room floor with an allowable variation of plus or minus 3°. The exterior walls of the outer room shall be protected from exposure to the direct rays of the sun.

The purpose of the test room shall be solely to maintain constant conditions about the radiator for relative tests and not to obtain absolute results.

The radiator for test shall be set on the floor as used in practice within 1½ in. of one wall. The relative humidity at time of test shall be within the limits of 35% to 60% and air motion shall be limited to natural circulation.

Air Temperatures—The radiator shall be tested in 70° F. air, plus or minus 5°. The temperature to be read at breathing line height (5 ft. above floor) in the center of the test room.

When the room air temperature differs from 70°, the condensate weight shall be reduced from the observed to a corrected value which shall take into account temperature variation from 70°.

Air temperatures shall also be taken within 9 in. of the floor and ceiling, in the center of the room and at various other points to determine the variation in heat distribution.

Temperatures outside of test room shall be taken at numerous points for purpose of comparison.

Thermometers used for measuring air temperatures shall be calibrated by comparison with a standard thermometer.

Steam Supply—Radiator shall be tested with steam at 1 lb. pressure and about 2° superheat. The superheat may be obtained by any approved method, such as wire-drawing through two control valves from higher pressure, or by means of a special (preferably gas-fired) superheater. Temperature of steam shall be measured by thermometer with bulb in the direct flow of steam.

Steam pressure shall be measured by mercury manometer.

Steam supply pipes both in and out of test room shall be insulated with 2 in. felt or air cell.

Condensate—The condensate should flow through insulated pipes with 2 in. felt or air cell from the radiator, without intervening valve, into an insulated receiver. From the receiver the condensate should pass through a trap to the weighing vessel, with provision made that no condensation shall be lost by evaporation. The weight should be read to at least as small a unit as ounces, but preferably hundredths of a pound.

Air Venting—The radiator shall be vented through the regular vent opening provided, by means of an approved standard commercial thermostatic type of air valve and also through an air valve or cock at top of condensate receiver.

Surface of Radiator—The surface of the radiator shall be cleaned and the entire surface then painted a neutral flat gray color.

Duration of Test—Tests shall not begin until a steady state of operating condition is reached. When this condition is reached the test shall continue for at least two hours.

Sources of Error in Radiator Testing—Sources of error in addition to accidental mistakes may be listed as follows:

a. Entrained water brought into the radiator with the steam.

b. Loss of condensate during the process of collecting and weighing, either by flashing into steam when pressure is released, or by evaporation from hot water surfaces to the air.

c. Escape of steam with the condensate and condensation of same in weighing vessel.

d. Incomplete venting of air from the radiator.

e. Air currents around the radiator differing from ordinary use.

f. Radiant effect of cold wall or glass surfaces, when exposed to low external temperatures.

Results of Tests—The heating capacity of a radiator shall be determined as follows:

$$\left.\begin{array}{l}\text{B.T.U. Emission per Hour at 70°}\\ \text{Room and 215° Steam Temperature}\end{array}\right\} = \left\{\begin{array}{l}\text{Pounds of Condensation per Hour} \times\\ 970 \times \text{Correction Factor.}\end{array}\right.$$

$$\text{Correction Factor} \left(\frac{215\text{-}70}{\text{Aver. Steam Temp.—Room Temperature}}\right)^{1.3}$$

Examples: Assumptions:

Condensation = 9.875 lbs. per hour.
Room Temperature = 76° F.
Average Steam Temp. at Radiator = 215° F.

$$\text{B.T.U. Emission} = 9.875 \times 970 \times \left(\frac{(215\text{–}70)}{(215\text{–}76)}\right)^{1.3} = 9.875 \times 970 \times 1.059 = 10{,}120 \text{ B.T.U.}$$

$$\text{Sq. Ft. of Radiation} = \frac{\text{B.T.U. Emission per Hour at 70°}}{240}$$

Example: $\text{Sq. Ft. of Radiation} = \frac{10{,}120}{240} = 42.2$

Michigan Chapter Greets Dean Anderson as President

Over 100 members and guests of the Michigan Chapter were on hand at the chapter's March meeting, held March 14, in the new Masonic Temple Building, Detroit, to greet Dean F. Paul Anderson, the new president of the society. Former President J. R. McColl spoke of Dean Anderson's early activities in the society and of some of his accomplishments during his regime as director of the society's Research Laboratory. E. E. McNair congratulated the society on having at its head such a man as Dean Anderson. L. A. Harding, of Buffalo, also made a brief talk in which he congratulated the chapter on its ability to increase its membership by using the "limited chapter membership" appeal. Mr. Harding was referring to a movement inaugurated by the Michigan Chapter providing for "limited" chapter membership. Up to date, this movement has brought in 47 new chapter members, as well as several applications for membership in the society.

President J. F. McIntire, of the Michigan Chapter, introduced Dean Anderson, who was given a warm welcome. He emphasized the importance of the work of the heating and ventilating engineer and paid his respects to the propaganda afloat against modern ventilation in school buildings. He laid great stress on the mutual advantage of having the younger men in the profession become affiliated with the society.

Following the meeting, the members and guests inspected the heating and ventilating equipment of the Masonic Temple Building, being escorted by Messrs. Widerhold, Homer and Cooper, of the Pittelkow Heating and Engineering Company.

Western New York Chapter Hears Talk on Unit Ventilation

"The Fundamentals of Unit Ventilation and Their Application" was the subject of an address by A. J. Nesbitt, of John J. Nesbitt, Inc., manufacturer of the Universal line of unit heaters, presented at the March meeting of the Western New York Chapter, held March 7, at the Hotel Buffalo, Buffalo, N. Y.

Mr. Nesbitt emphasized the importance of air in motion in the schoolroom, and explained that this was made possible by using high velocities at the discharge of the unit by blowing in a vertical position, this velocity varying from 800 to 1000 ft. per min.

The fact that some method of properly humidifying the air is necessary was brought out by Mr. Nesbitt. The present units may be equipped with air filters for removing dust, soot, etc., but no satisfactory method of controlling the humidity has as yet been devised.

The average capacity of the schoolhouse unit heater is about 190,000 B.T.U. per hour, the capacity from 1200 to 1300 cu. ft. of air per min., the dimensions varying somewhat, but coming within 4 ft. x 3½ ft. high, and 14 in. to 18 in. in thickness.

There were numerous questions asked and general discussion followed at the close of Mr. Nesbitt's talk. He recommended the omission of direct radiation in schoolrooms, stating that the absence of this compelled the use of the unit for heating purposes as well as ventilation, while, if direct radiation is installed for heating, there might be a tendency to stop operation of the unit with the idea of saving fuel.

The talk was accompanied by a number of slides showing typical installations.

President Jackson announced that Dean F. Paul Anderson, president of the Society, would attend the April meeting with about 65 members of his senior class of engineers from the University of Kentucky.

Dean Anderson Honored at Birthday Dinner

A REMARKABLE tribute of affection and esteem featured the 60th birthday of F. Paul Anderson, on February 10, when over two hundred gathered from all parts of the country to join at a dinner in his honor.

The gathering was notable because, while it included men from all sections of the country, they were not members of any single group, but rather representatives of the many phases of industry and education into which Dean Anderson's activities have permeated. Included in the gathering were representatives of Purdue University, from which Dean Anderson graduated with the class '90; from the University of Kentucky, with which Dean Anderson has been associated since 1891; the American Society of Heating and Ventilating Engineers, of which he is the president, and many from other national and educational associations and societies with which Dean Anderson is identified.

J. I. Lyle, treasurer and general manager of the Carrier Engineering Corporation and a graduate of the class of '96 University of Kentucky, acted as toastmaster and introduced the speakers of the evening. Mr. Lyle is one of the oldest of thousands of "Dean Anderson's Boys," who have had the intimate contact with him that is usually denied in the larger universities, and who have gone out into every branch and walk of engineering life.

As the Dean had just arrived from the sick bed of his aged mother, this circumstance contributed an atmosphere of sadness to the occasion, yet it gave rise to a remarkable demonstration of sympathy and affection for him who, during his entire life, has given unstintedly of himself.

Dean Mortimer E. Cooley of the College of Engineering and Architecture, University of Michigan, responded to the toast, "Dean Anderson and Engineering."

"I would have traveled much farther to pay tribute to Dean Anderson," said Dean Cooley, as he related the early successes of Paul Anderson and told of his association in the Research Laboratories with the Southern Railway and with the American Society of Heating and Ventilating Engineers.

"Dean Anderson has lived a great life and his greatest work has been in training young men for the engineering profession."

"Dean Anderson and Research" was the subject of a talk by E. S. Hallett, chief engineer of the Board of Education of St. Louis, while John D. Cassell, who was recently awarded a special medal by the Society of Building Engineers in Philadelphia, spoke on "Dean Anderson and Heating."

Superintendent M. A. Cassidy of the Lexington public schools, spoke on "Dean Anderson and Education."

H. P. Ingels of New York, also a graduate of the College of Engineering, class of 1905, had for his subject "Dean Anderson and 'His Boys'."

At the close of his remarks Mr. Ingels presented Dean Anderson with the keys to a beautiful five passenger Packard six sedan, the gift of the alumni and his other friends, as an expression of their esteem.

The Dean is proud of his new car. He calls it, "a big bundle of affection." He is still more proud of what he considers his greatest asset—his friends.

On the program was printed the following tribute, which also appeared in the guest book signed by those present.

"It is characteristic of our kind that when our fellows perform service of distinctive worth, to memorialize them, in poetry, in song, in story, with chiseled statue or polished brass, that men may measure our veneration by the outward act.

"But we are come together here to launch no epic, to unveil no monument,

Dean Anderson and his new car together with some of the Committee: D. V. Terrell, C. C. Jett, H. C. Anderson, F. Paul Anderson, N. T. McKee, W. E. Freeman, J. R. Johnson

to pronounce no panegyric. Rather are we met by common impulse to strike hands in living faith with a comrade tried and true, who has blazed trail to useful goal and made it luminous by loving service.

"As no man liveth unto himself alone so no man can labor for himself alone, but rather perforce through daily duty does he scatter his seed to the common air and give the substance of his husbandry to the common good.

"The honor guest who sits with us here has reached that vantage point on life's journey where it is given to him to pause and look back down the dusty road, through three score years of faring, touched perhaps sometimes by travail, but sanctified we know by helpful thought for those with whom he journeys. Here also he may stand and look forward with contented heart toward the approaching evening hour, made splendrous through memory of duty finely done, and shorn of burden or loss or sense of vain regret.

"His life has been, still is, and for long years we trust, will be a busy one. For to such as he, only through this can real happiness come; to such as he, labor is gospel and the dead calm of ignorance and inaction is sin against the Holy Ghost.

"So tonight we lift the glass filled to the brim with good fellowship to you sixty years young, true to friend, generous to foe, in love with life, tolerant of a fellow's weakness, broken by his woe, with 'color, form and music touched to tears:' strong among the strong, generous among the weak, and through the winding years of time and change and fate, on rough sea or out on sunlit wave, we bid you 'bon voyage' and long, long life, content and peace with opportunity to continue long to serve."

Research Laboratory to Expand Its Activities

Definite information on the plans of the Research Laboratory for making tests for other associations for pay, have been announced by Chairman S. R. Lewis, of the Committee on Research.

Mr. Lewis states why the laboratory ought to give the widest possible service to the public and not be limited to the fundamental research of basic principles, which have occupied nearly all of its time and funds so far.

"Constant inquiries," he states, "come to the laboratory for an exposition of the terms upon which work will be undertaken, and the committee believes that it has accomplished something in the first month of its 1927 service, in having developed and agreed upon this."

Referring to the tests made at the Research Laboratory on the color-effect of roof surfaces on transmission of heat through roofs, Mr. Lewis makes the prophecy that we may see trains of a transcontinental railroad painted white in summer, on account of these observations. "The opinion has been advanced," he said, "which may be verified or exploded in our laboratory, that the electric fans which were so ineffective in parked sleeping cars on summer nights waiting for the 2.00 a.m. train, would do very much more good if placed outside the car, blowing against it, while one of the time clocks, made by our temperature regulating confreres causes the occasional wetting-down of the steel exterior from a spray nozzle. Lick the back of your hand; blow on the licked spot, and entertain the idea!"

National District Heating Association

Development Committee Permanently Organized

Following several preliminary meetings of the Development Committee of the National District Heating Association, permanent organization, it is announced, has been effected, with John W. Meyer, as chairman. The other members are W. K. Abernethy, C. Gottwald, J. C. Hornung, J. D. Pryor, and Arthur J. Slade, representing the associated membership, and D. S. Boyden, Charles H. Day, R. D. DeWolf, J. H. Walker, and John W. Meyer, representing the class B membership. H. R. Wetherell, secretary of the association, is also acting as secretary of the committee.

It is the purpose of this committee to foster the development of district heating as a co-ordinated branch of the utility business—to bring about co-operative effort between the electric utilities and other interests in the heating field for such developments along fundamentally sound economic lines—to assist in correcting the errors of the past as far as is possible—to prevent repetition of such errors in the future—and to avoid untimely developments or developments having slight prospect of success.

This program contemplates the development of the district heating industry, by advising with management, sales managers and operating engineers of heating and electric utilities in all matters pertaining to the operation and maintenance of heating projects. It does not contemplate general publicity, but will promote publicity in communities only where such is desired by the local utilities involved.

To this end, two activities will be pursued:

(a) The building up in the minds of utility executives and managers of a favorable attitude toward the development of district heating business.

(b) When agreeable to the utilities involved, the building up in the minds of present and prospective consumers of an appreciation of the real value of district heating as a service proposition.

Messrs. Pryor, DeWolf and Meyer, were appointed a committee of three to carry out the program of the committee. In the meantime, the committee is asking the members to contribute to the effort by improving the operating and financial conditions of the property, in which they are directly concerned, by maintaining a constructive attitude toward the industry as a whole, by increased association activity and in other ways.

Subjects for the Heat Utilization Committee

Some idea of the work being undertaken by the Heat Utilization Committee is given in the outline of the subjects to be covered, in this year's report.

1. Continue the collection of data similar to that found in previous reports. (a) What figures have you on recent heat savings, due to temperature control, etc.?

2. Follow up the results obtained by Heat Use Booklet and suggest methods of using the booklet. (a) Have you used the booklet in your city? (b) How many? (c) How? (d) With what results? (e) How do you put the heat saving across to your customers?

3. Extend the scope of the information concerning steam service work with customers. Include information on methods of selling heat saving and steam service to the managers and engineers of buildings. (a) How do you keep in touch with your new and old customers? (b) Who handles your complaints? (c) Who handles bill complaints and adjustments?

4. Promote the Heat Use talks before the local building owners and managers. Earle Shultz will have charge of this work and will be glad to co-operate with you in arranging a local meeting. Reports of these meetings should be sent direct to Mr. Schultz.

5. Study the possible effects of the proposed steam demand rates on present methods of heat utilization. (a) What effect do you believe will result from the adoption of a peak demand rate? (b) How should our Heat Use Recommendations be changed to agree with the demand rate?

6. Study possible off-peak uses of steam. (a) In what way is the sale of steam promoted in your city during the off-peak period? (b) Have you a summer steam rate? (c) What summer loads have you?

7. Compile data regarding peak load periods of customers and complete systems. Please submit any data you have available on this subject.

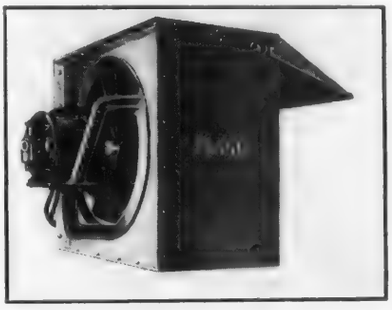
8. Report on the compression of low pressure steam.

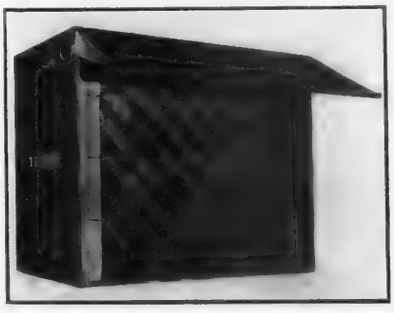
New Apparatus and Appliances

Trane Unit Heater

An extended-surface type of unit heater, unique in that it uses as a heating unit a battery of heaters similar in construction to the heating units used in the Trane heat cabinets and concealed heaters, has been brought out by The Trane Company, La Crosse, Wis.

The heating unit is made up entirely of copper without soldered or brazed joints. The copper sheets, which form the extended surface, are fastened to the copper tube or core by means of the exclusive Trane process which forms a perfect connection without soldering or brazing. This construction eliminates all chance of leakage in the heating unit or in loss of heat through poor





Two Views of Trane Unit Heaters Using Copper Extended Surface Type Radiators

contact. Standard units operate on pressures up to 125 lbs.; special heaters are available for higher pressures.

The motors used on the fans are of standard make. The fans are constructed of heavy aluminum, with brass hub, and are direct-connected to the motor. The fan is especially designed for this type of heater and is carefully balanced.

The heaters are arranged for ceiling suspensions but they can be used as floor-type heaters with recirculating boxes, when desired, or they can be arranged with fresh air intake.

The casing surrounding the heater is made of heavy steel plate and is strongly reinforced to give rigidity. A deflector is furnished as standard equipment.

Four sizes are available, with rated capacities of 468, 705, 936 and 1410 sq. ft. of E.D.R. at 5 lbs. steam pressure when placed in a room having a temperature of 50° F. These capacities change 863, 1185, 1726 and 2370 sq. ft., respectively at 100 lbs. pressure.

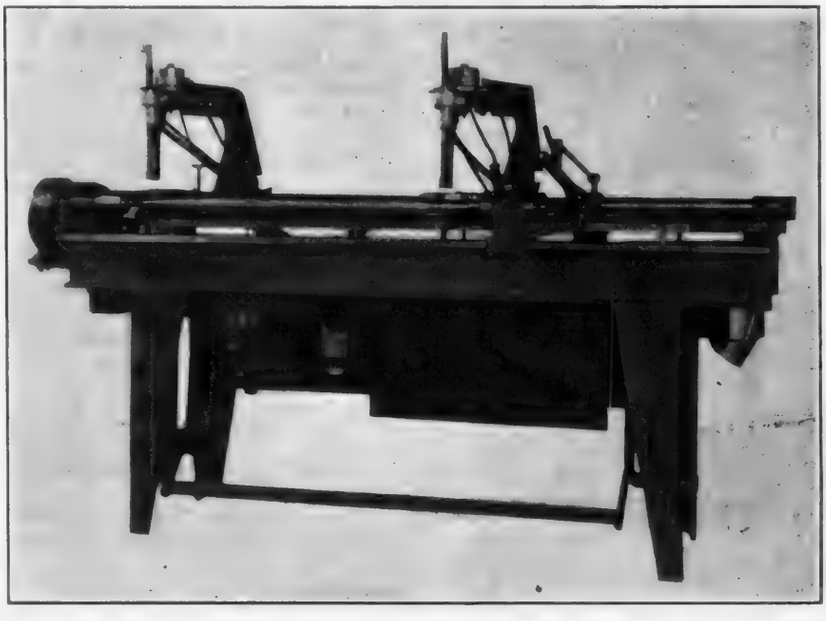
New Butt-Welding Machine Operates with Carbon Arc Process

Among the types of welding equipment, brought out in recent months, the automatic machines for electric arc welding are among the most interesting. It was only a few years ago that most people believed electric arc welding would always remain a manual process in which the skill of the operator would be the limiting factor. Yet, in the last twelve months, numerous new machines have appeared on the market for doing welding by machine which had formerly been done by hand.

The machine here illustrated is a further development of the machine-driven carbon arc to the problems of welding. One ordinarily thinks of butt-welding in terms of the resistance welder. The arc butt-welder is not an alternative method of doing butt-welding, but is claimed to be a solution of a class of butt-welding problems which the resistance welder cannot solve.

As an instance of this, a plug easily may be welded into the end of a tube with the arc butt-welder, although the job would be impossible with a resistance butt-welder. The machine illustrated welds both ends of the tube at the same time by use of the two automatic heads.

The motor generator set used to supply current for the arc supplies direct current at 40 to 60 volts. This machine is manufactured by the Lincoln Electric Company, Cleveland, O.



Lincoln Butt-Welding Machine

Design of Buffalo Hi-Pressure Unit Heaters

Some idea of the characteristic features of the new Buffalo Hi-Pressure unit heater may be had from the accompanying illustration of a typical unit. As described in last month's issue, the heating coils of ½-in. steel pipe are assembled in staggered rows between two extra-heavy steel headers. The units are designed for steam pressures as high as 150 lbs. per sq. in.

Buffalo Hi-Pressure Unit Heater Showing Motor Drive

Each heater is equipped with two Buffalo Conoidal fans. One, two, or four-way discharge openings can be furnished, as desired.

The units may be arranged with flexible couplings and motor sub-base for direct connection, or supplied with bracket for mounting motor when of the belted type. Steam and drip connections may be made at either side of the heater.

Four sizes of these units are available, containing 720, 1120, 1960 and 2360 lin. ft. of ½-in. pipe respectively, and requiring 1 to 7½ H.P. These are built by Buffalo Forge Company.

Air Valve With Unique Features

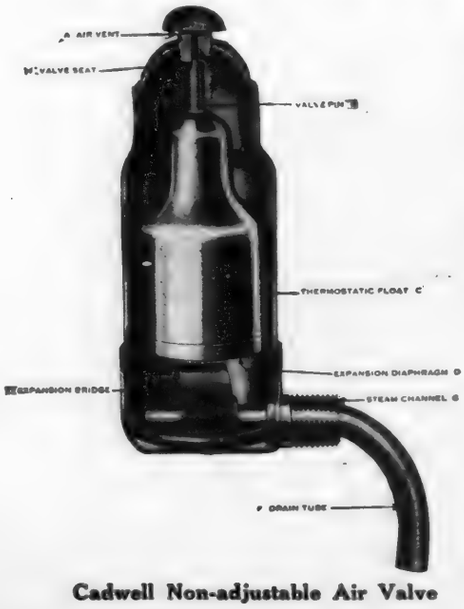
A non-adjustable automatic air valve, with fluid control and possessing interesting construction features, has been brought out by the Beaton and Cadwell Mfg. Co., New Britain, Conn., under the name of the Cadwell No. 10 non-adjustable air valve.

In addition to the type shown, this valve is manufactured with a bottom outlet for venting risers or coils. They are made both in ⅛-in. and ¼-in. size. The company also manufactures a clamp so that the valve can be attached to the radiator in such a way that it could not readily be removed.

With the air valve in operation as steam enters the radiator, cold air enters the valve through steam channel (G) and escapes through air vent (A). In its passage through the valve the steam comes in contact with thermostatic float (C) which contains a fluid which expands diaphragm (D). This lifts the float (C) and drives the valve pin (B) into the valve seat (H), closing the valve.

The drain tube (F) siphons back into the radiator any condensation that may accumulate in the valve. The expansion bridge (E) is designed to take care of any exceptional strain that may be placed on the valve, due to excessive steam pressure.

Care has been taken to conceal the air vent (A) as much as possible by making it in the form of a horizontal hole, to eliminate possibility of tampering. The valve is listed at $1.00 and is guaranteed for five years.



Cadwell Non-adjustable Air Valve

A Glass That Transmits Ultra-Violet Rays

A new product, recently brought out by The VitaGlass Corp., 50 East 42nd St., New York, under the name of VitaGlass, is characterized as capable of transmitting ultra-violet rays to the extreme limit of the sun's spectrum, including the vital range.

It is described as a true glass of high quartz content to which certain rare elements have been added. Not only is it clear and transparent, but it may be cut, sized, and installed like ordinary window glass.

VitaGlass is available in two forms: Cathedral VitaGlass, which gives a slight diffusion and indistinctness of vision, making it suitable for roofs, walls, sun parlors, and wherever clarity of vision is not important or when it is desirable to obstruct vision; and clear VitaGlass, which permits the same unobstructed vision as ordinary window or plate glass.

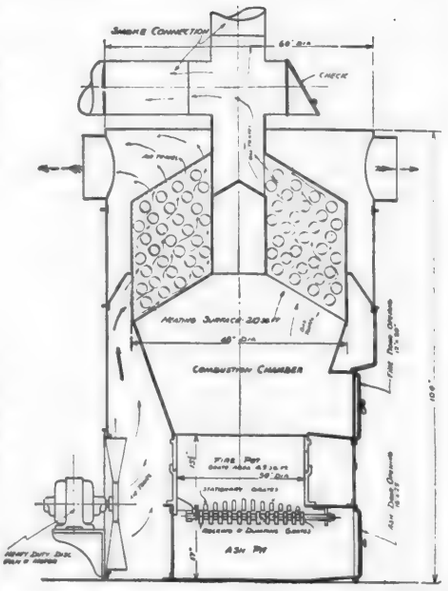
VitaGlass is listed as $2.00 a square foot. The Cathedral glass is from 2½ to 3 mm. thick, approximately 24 to 26 oz. to the square foot, while clear Vitaglass is about 2 mm. thick and approximately 22 oz. to the square foot. The glass can be supplied in any quantity and any sized panes for ordinary glazing purposes. However, the manufacturers do not recommend panes over 4 or 5 sq. ft.

Transmission tests reported by the company indicate that VitaGlass permits the passage of 50% of the ultra-violet rays in direct sunlight and as high as 65% of the ultra-violet rays received from indirect sources, such as skyshine and cloudshine. These determinations were made by the U. S. Bureau of Standards, Professor Webb, of Columbia University, Professor Pfund, of The Johns Hopkins University, and others.

Another test reported by the company, made in schoolrooms by the Smethwick Education Committee, in England, showed notable gains by the students in the matter of weight, height, and the percentage of red corpuscles.

Thermair Fan-Furnace

A warm-air unit heater, capable of heating a building of approximately 10,000 sq. ft. floor area, is a recent product of the New York Blower Co., Chicago, Ill. This unit consists of a specially developed warm-air furnace, topped by a steel radiator, consisting of 20 radial sections of electrically welded steel, so arranged as to provide a maximum gas travel. The combustion chamber is of steel, formed integrally with the radiator.



Section Through Thermair Fan-Furnace

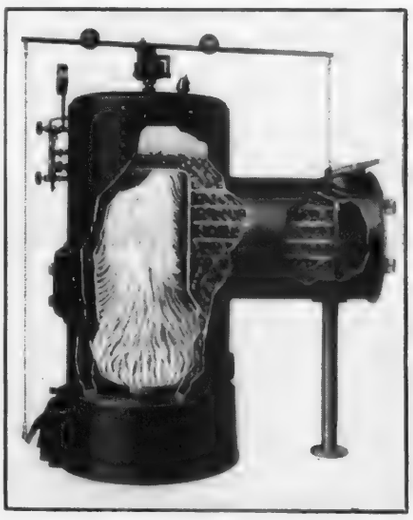
Incorporated in the front of the ashpit is a heavy-duty disc fan, direct connected to an electric motor. This draws the air in from the floor line and, after passing through the furnace jacket and radiator, it is blown out through one, two, four or six exhaust ducts, as installation conditions may require. The unit is so constructed that it can be assembled and erected in a single day.

The capacity of this unit is equivalent to that of a cast-iron boiler of 5000 sq. ft. rating. The input to the motor is only 600 watts.

Thermair Warm-Air Furnace with Fan

New Trade Publications

HOW THE BOILER YOU CAN AFFORD TO OWN HAS BEEN MADE THE BOILER YOU CAN AFFORD TO BUY is told in a new catalog issued by the Fitzgibbons Boiler Co., 570 Seventh Ave., New York. The text is out of the ordinary in presenting a readable story of the rise of the Fitzgibbons steel boiler during the forty years it has been on the market and its subsequent development since Homer Addams acquired the company. The boilers are now manufactured in a variety of sizes, ranging in capacity from 400 to 36,000 sq. ft. of direct radiation, in the low-pressure types, to boilers designed for 150 lbs. pressure, in the high-pressure types. The point is made that Fitzgibbons steel heating boilers are not only reasonable in price, but are easy to install, at the same time occupying a comparatively small amount of floor space. Low maintenance expense, it is stated, is due to the simplicity of the boiler's cylindrical design and the accessibility of the entire interior of the boiler. Other points mentioned are the large volume of the



Fitzgibbons Steel Heating Boiler

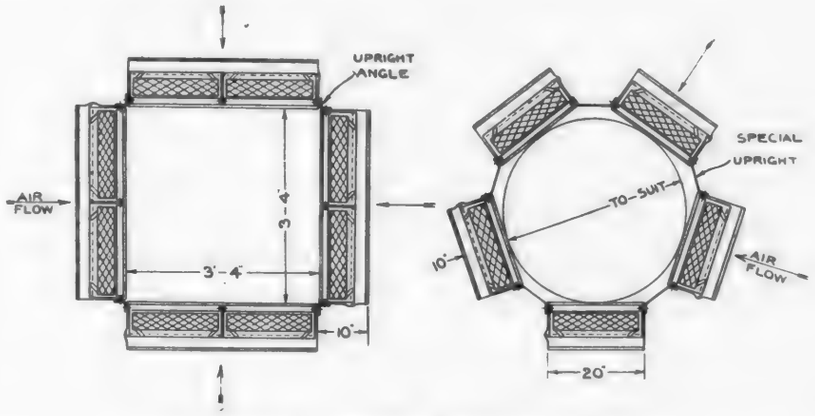
boiler's combustion chamber so as to provide for efficient heat absorption, the small tubes for transmitting the heat more rapidly and effectively and the rapid and positive circulation. Fitzgibbons boilers, it is stated, are adapted to any fuel although with oil, of course, the boiler setting varies with the type of burner used. Full ratings are included for each type, including double electric-welded furnaces in sizes from 400 to 3200 sq. ft. steam rating, double electric-welded furnaces in sizes from 3800 to 16,500 sq. ft. steam radiation, and all-riveted construction in sizes from 4200 to 36,000 sq. ft. steam rating; also steel power boilers in sizes from 40 to 350 H.P. Size 5 in. by 8 in. Pp. 32.

MOTO-GAS GASOLINE GAS MACHINE is described in a circular received from the Moto-Gas Machine Co., Minneapolis, Minn. This company manufactures machines producing a fixed gas of about 950 B.T.U. per cu. ft. and available for use in ranges, stoves, water heaters and gas-fired boilers. It is stated that this equipment will automatically produce gas at an average cost of $1.50 per 1000 cu. ft. The catalog fully describes and illustrates the scheme of operation and the equipment used.

ELECTROZONE SYSTEM OF VENTILATION is described in a bulletin issued by The Air Conditioning & Engineering Co., St. Louis, Mo. This pamphlet is illustrated with photographs of many important schools and other public buildings and industrial plants where this scheme of ventilation has been installed. There is involved the recirculation of the larger part of the air in the building and the treatment of this recirculated air with ozone to remove the odors and destroy the bacteria. It is stated that with 75% recirculation a large reduction in initial cost of the heating and ventilating plant is effected, as well as a material reduction in operating costs.

PISTON VALVES (KLINGER PATENTS) are featured in bulletin 8-T issued by Schutte & Koerting Co., Phila., Pa. These valves eliminate flat or beveled seat-faces, the shut-off being obtained by a cylindrical piston or plunger sliding vertically through two special packing rings separated by a bronze cage or lantern having ports through which the steam or other fluids flow when the valve is open. A standard handwheel and screw spindle are used to regulate the position of the bronze piston, and the stuffing-box and its nut provide a means of compressing the packing rings to insure a close fit around the sliding piston. Due to the sliding action the valves are easily opened and closed. Only the lower end of the plunger is exposed to the high-velocity effect of the steam or other fluid when the valve is starting to open or is nearly closed, and a slight wear at this point will not affect the tightness of the valve as there is ample piston area in contact with the packing rings when the valve is closed. The valves with bronze piston are made in sizes from ¼-in. to 2-in.

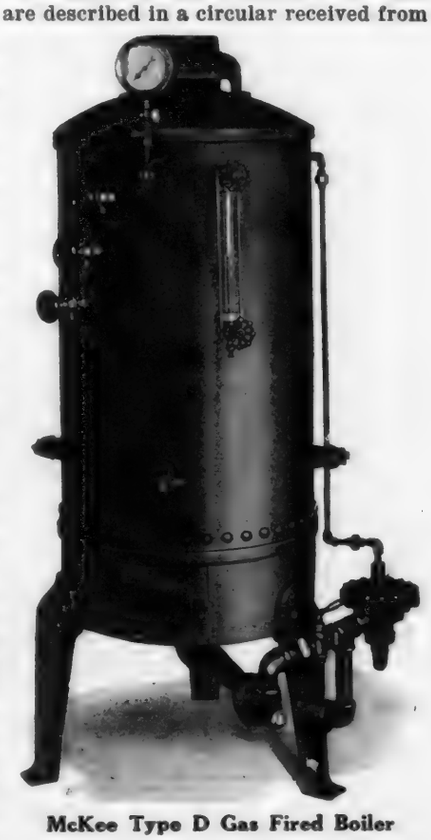
MIDWEST AIR FILTER DETAIL SHEETS are incorporated in an interesting folder received from Midwest Air Filters, Inc.,



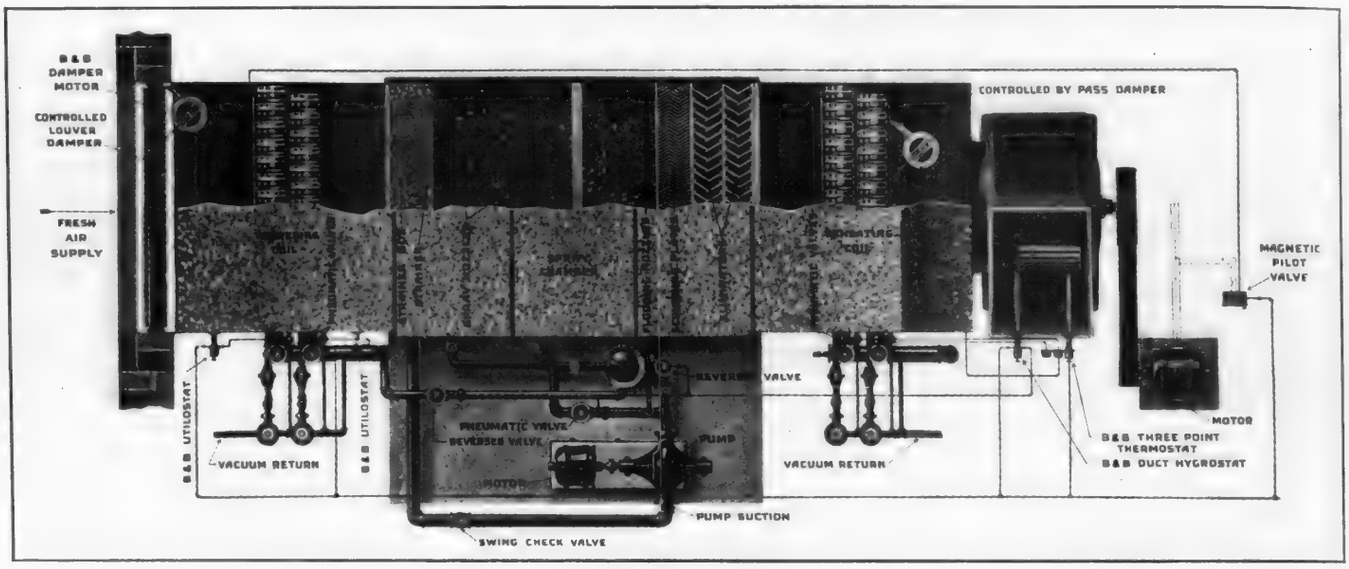
Two Methods of Installing Midwest Air Filters

Bradford, Pa. This folder details many combinations to which Midwest air filters are adapted, giving dimensions and structural details of installation. Size 8½ in. x 11 in. Pp. 16.

MCKEE AUTOMATIC GAS-FIRED BOILERS are described in a circular received from



McKee Type D Gas Fired Boiler

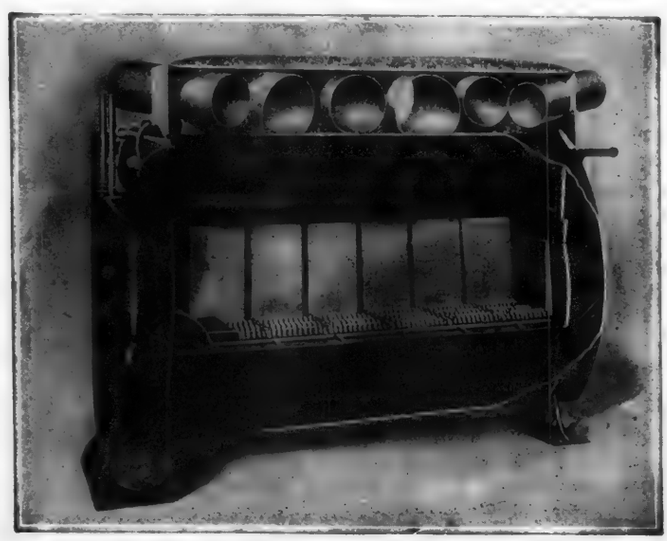


Typical Arrangement of Massachusetts Heating, Ventilating and Air Conditioning System

Eclipse Fuel Engineering Co., Rockford, Ill. This firm manufactures a line of boilers, rating from ½ H.P. to 30 H.P. for various specialized purposes. One type is particularly for furnishing steam to glove molds, vulcanizing molds and steam tables. Another is designed primarily for newspaper work and others up to 30 H.P. are tested at 150 lb. pressure for general heating purposes. These boilers are constructed strictly to the A.S.M.E. power code and conform to all state laws.

HEATING THE HOUSE BY A MODERN METHOD is the title of an arresting publication, with a black and gold cover, issued by the Farquhar Furnace Co., Wilmington, Del. The manufacturer discusses the matter of house heating at some length and asserts that ventilation and heating are so inter-dependent that they must be embodied in the same system. This is followed by an explanation of "Farquhar" vent and return system. The "Farquhar" welded steel and self-regulating furnace is then taken up and its details described. In the latter portion of the pamphlet is a section entitled, "A Study in Furnace Design." Size 6 in. x 9 in. Pp. 16.

MASSACHUSETTS AIR WASHING AND AIR CONDITIONING SYSTEMS is the designation of a booklet put out by the Massachusetts Blower Division of the Bishop and Babcock Sales Co., 4901-4915 Hamilton Ave., N. E., Cleveland, O. This catalog is arranged with an extension on the back cover so as to accommodate itself readily to vertical filing. The descriptive matter relates to air washers and air-conditioning apparatus, including dimensions and engineering data. An explanation is also given of the operation of the Massachusetts heating, ventilating and air-conditioning system and a form is included for specifying equipment. At the end of the catalog a list of representative work is tabulated among which is the Mantetsu General Hospital at Dairen, Manchuria, built by the South Manchuria Railroad and containing six complete sets of Massachusetts air-conditioning equipment, as well as six special exhaust fans. Size 8¾ in. x 11¾ in. Pp. 32.



Farquar Steel Furnace

HAMBURG TANKS is the title of a booklet issued by the Hamburg Boiler Works, Inc., Hamburg, Berks Co., Penn. This publication is devoted to the matter of tanks in a variety of sizes, forms and for various uses. Pneumatic storage tanks, pneumatic water tanks, horizontal and vertical air receivers, water tanks and hot water storage tanks, both with and without heating coils, are covered. Size 4 in. x 8 in. Pp. 23.

INSTANT STEAM WATER HEATERS are described in a circular issued by Instant

Instant Steam Water Heater

Water Heater Sales Division, Inc., 332 South Michigan Ave., Chicago. Supplementing the description of this, which was published recently, the accompanying illustration shows in detail how the device operates. As will be seen, the chambers are so arranged that the cold water entering the heater passes through the central chamber the full length of the heater, surrounded by steam which is confined in the second chamber. The water then returns spirally in a thin sheet along the outside wall of the steam chamber, absorbing in its travel all possible latent heat of vaporization.

SPEAKING OF MECHANICAL EXCELLENCE is the basis of a folder distributed by the Aerofin Corp., 750 Frelinghuysen Ave., Newark, N. J., on Aerofin heaters. The folder states that every unit is delivered complete, each joint having been tested to 100 lbs. steam pressure and that all details of assembly have been foreseen and performed before the unit is packed. This is followed by a description of Aerofin construction and details of assembly. Size 5½ in. x 8 in. Pp. 8.

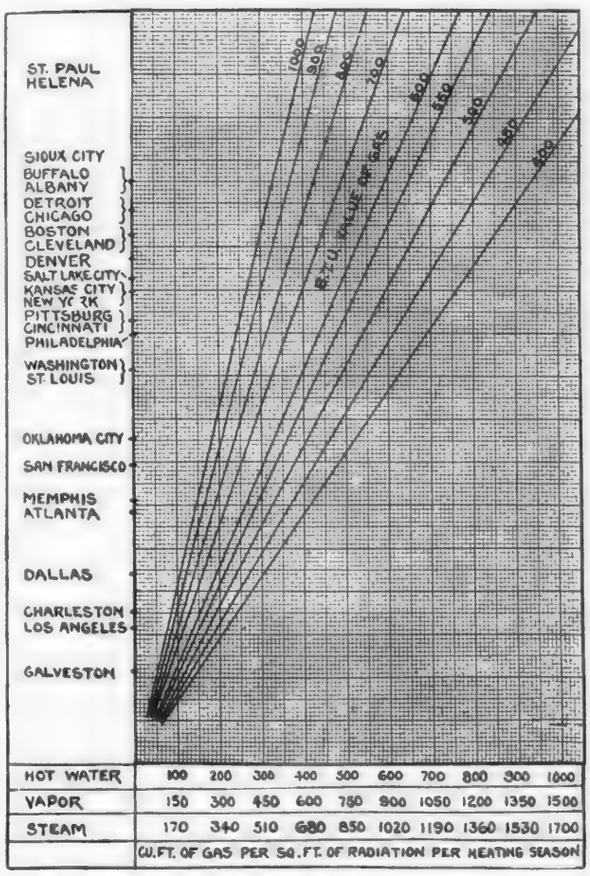
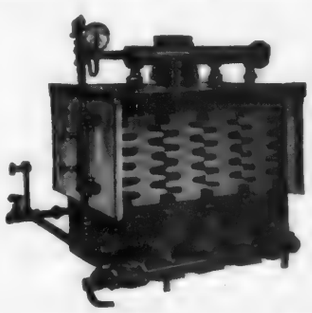


Chart for Computation of Gas Consumption for Heating Purposes

HEAT WITH GAS AND THE AUTOMATIC FURNACEMAN is the name of a booklet on the Heatomat gas boilers, being distributed by the United Utilities and Engineering Corp., Philadelphia, Pa. Besides a complete description of the gas-fired boiler, this catalog contains comparative data on cost of heating by gas and by coal, as well as information on Heatomat hot water storage systems for domestic hot water service. Size 8½ in. x 11 in. Pp. 16.

GAS-FIRED BOILERS AND WATER HEATERS is the title of a loose-leaf catalog put out by Mears-Kane-Ofeldt, Inc., 1903-1915 East Hagert St., Philadelphia, Pa. This publication features the Kane vertical



Kane Cast-Iron Gas-Fired Boiler

steel tubular and cast-iron sectional boilers, gas controls, Kane automatic gas-fired steam boilers, hot water coil heaters for service use and Ofeldt automatic gas-fired steam boilers. Size 8 in. x 11 in. Pp. 30.

CENTURY MOTORS, for use with oil burners, electric refrigeration systems and house pumps, are described in a bulletin issued by Century Electric Co., St. Louis, Mo. These fractional-horsepower repulsion-start induction single-phase motors have been highly developed through a period of nearly twenty-five years and to-day present several interesting features of design and operation. A special scheme of lubrication provides for one year's actual refrigerator, oil-burner or house-pump service without lubrication attention. This service is secured through the use of the large lubricating well, packed with pure wool yarn. The bulletin gives the details of the break-down test described in THE HEATING AND VENTILATING MAGAZINE for November.. One reason given for the motor's long serviceability is that as the brushes are withdrawn from the commutator, as soon as the motor reaches speed, the motor is remarkably free from noise when in operation. The magnetic "hum" has been greatly reduced and the mechanical vibration is, to a large degree, eliminated by giving each armature a dynamic balance, during which any slight inequalities are compensated. The bulletin gives much valuable detailed information on the motor and illustrates the break-down test referred to.

AMERICAN TACHOMETERS are described in catalog No. 500 just issued by American Schaeffer & Budenberg Corp., Brooklyn, N. Y. This firm, as is well known, has long specialized on tachometers adaptable to almost any need, and the catalog in addition to portraying the different types of instruments incorporates a photograph of a tachometer of each style in use. In addition to a very complete line of indicating tachometers, a recording type using a circular chart is listed, also a combination indicating and recording tachometer using a 16-in. strip of paper which is carried on a cylindrical drum. Several types of hand tachometers are also included in the catalog. Size 8 in. x 11 in. Pp. 24.

THE PUBLIC CHOOSES WHAT IT WANTS, a broadside issued by the Newport Boiler Co., Chicago, Ill., contains a striking chart showing the astonishing growth in the sales of Newport magazine-feed boilers, particularly during 1925 and 1926. In spite of the fact that 1925 sales were double those of 1924, the 1926 record was nearly a third higher than 1925. Among the reasons given for the popular endorsement of this boiler are its magazine feature, its even fuel bed but, above all, its ability to burn No. 1 buckwheat coal at an estimated saving of 50% over the more expensive sizes.

BRYAN OIL-BURNING BOILER is described in a circular received from the Bryan Steam Corp., Peru, Ind. The Bryan boiler is designed especially for oil and gas burners, in the former case being mounted on a high combustion chamber and in the latter case, on a lower one. The folder enumerates the various constructional points and advantages of this boiler and concludes with a list of advantages accruing to dealers handling it.

The Keystone Coil Boiler

In view of the adaptability of the coil type of boiler to oil burners, the construction features of the Keystone coil boilers, manufactured by the Keystone Boiler & Foundry Co., Landisville, Pa., will be found of interest. As will be seen from the accompanying illustration, these boilers are of the round type, with annular water spaces. Spiral water-tubes or coils constructed of wrought-iron pipe are so nested above the combustion chamber as to absorb a large amount of the available heat in the products of combustion. The shape of the coils permits a rapid water circulation.

Due to a transposition of illustrations in the March issue the picture labeled Keystone coil boiler was in reality that of a different type of heater.

Keystone Coil Boiler

Present Accepted Practice in Domestic Oil Burners

As this issue contains so much editorial material dealing with domestic oil burning, it has seemed advisable to omit the serial matter appearing under this heading. The series will be resumed in the May issue.

Fundamental Oil Combustion Facts to be Sought in New Research Laboratory

An Oil-Burner Research Laboratory has been instituted at the University of Kentucky. A special room is being built in the thermal laboratory, and will be devoted to fundamental research in the realm of oil combustion. For the present, the laboratory equipment will consist of four new house-heating boilers of different types and as many oil burners of differing characteristics.

A research committee has been organized, consisting of F. Paul Anderson, Dean of the School of Engineering, P. E. Fansler, Associate Editor, THE HEATING AND VENTILATING MAGAZINE, and a representative of each of the manufacturers supplying equipment for the laboratory.

Basic research will be carried out for the benefit of the industry at large rather than for any individuals or industrial organizations.

New York "Own Your Home" Exposition

The ninth annual "Own Your Home" Exposition featured many heating and ventilating exhibits at Madison Square Garden, New York, February 19-26. These exhibits occupied separate sections and included, besides heating appliances, building insulating materials and weather stripping.

Among the exhibitors were the following:

Fitzgibbons Boiler Co., New York, exhibiting small Fitzgibbons Steel boilers for house heating.

Estate Stove Co., Hamilton, O., exhibiting Heatrolas.

Consolidated Gas Co., New York, displaying a variety of appliances including the Ideal Arcola, a production of the American Gas Products Corporation, also Ideal gas boilers.

Bryant Heater Mfg. Co., Cleveland, O., displaying Bryant standard gas boilers, also gas water heaters.

Cleveland Heater Co., Cleveland, O., showing Rex automatic heater.

Home Incinerator Co., Milwaukee, Wis., displaying the rubbish incinerator.

Crane Co., Chicago, Ill., displaying hot water heaters.

Universal Gypsum & Lime Co., Chicago, Ill., displaying Insulex in a variety of applications.

Armstrong Cork Co., Pittsburgh, Pa., insulating materials.

United Cork Co., Lyndhurst, N. J., showing insulating materials.

Celotex Co., Chicago, Ill., giving demonstrations of the various uses of Celotex.

Wood Conversion Co., Cloquet, Minn., displaying balsam-wood insulating materials.

Chamberlin Metal Weather Strip Co., Detroit, Mich., exhibiting Chamberlin weather-stripping.

Monarch Metal Products Co., St. Louis, Mo., displaying Monarch metal weather-stripping.

Art Craft Radiator & Enclosure Co., New York, exhibiting radiator cabinets.

Domestic Stoker Corp., New York, automatic stokers for house heaters.

Uses of Celotex Industrial Board and Standard Building Board

In THE HEATING AND VENTILATING MAGAZINE, for December, 1926, an article was published under the heading of "Chart for Figuring Celotex When Used for Roof Insulation." This article had to do with a chart recently published by The Celotex Co., 645 North Michigan Ave., Chicago, for determining the thickness of Celotex required to prevent condensation for any given set of temperature and humidity conditions, and roof construction.

In the discussion regarding this chart, it was stated that the use of Celotex industrial board is being advocated by the manufacturer, for residences and roofs. It was also stated that Celotex industrial board "is designed primarily for roof insulation but may be used under plaster as sheathing, or insulating in the structural requirements of residences."

The manufacturer states that this particular product is not to be used where it is applied in any way structurally, such as under plaster, for wall sheathing, interior finish, exterior finish, etc. Celotex standard building board should be used for these purposes. The industrial board, which is manufactured in one size only, 3 ft. by 6 ft. by approximately ½ in. thick, is intended to be applied where it functions solely as an insulation, such as for roof insulation, and sound heat insulation, where it is in no wise used as a structural material.

Among the other major uses of Celotex industrial board are oil-tank insulation, dry-kiln insulation, ventilator ducts, carpet and linoleum lining, and winter protection of construction work taking the place of tarpaulins.

Where the Celotex is to be used as a base for plaster, or as sheathing, interior finish, exterior finish, or roof sheathing, the standard building board should always be used. This product is 4 ft. wide, 7/16 in. thick, and is made in lengths from 8 to 12 ft.

The Celotex Company has also prepared charts for determining the saving in radiation in fuel, resulting from the application of various thicknesses of Celotex industrial board to different types of roof decks.

Another interesting pamphlet, intended primarily for architects and engineers, is that containing coefficients of transmission of walls, roofs, ceilings and floors, without insulation, and insulated with various thicknesses of Celotex.

National Association of Plumbing and Heating Salesmen, second annual convention of which will be held in Newark, N. J., May 26-28, will be addressed, at its annual banquet on the 28th, by Gov. A. Harry Moore of New Jersey. W. G. Boales, Detroit, is president of the organization and William F. Weber, secretary.

Deaths

GEORGE REDFIELD NIXON, secretary and a director of the Continental Heater Corp., Dunkirk, N. Y., died on February 17. Mr. Nixon was born at Westfield, N. Y., in 1889. In 1917, when the United States entered the World War, he enlisted and served in the naval service until the end of the war. In 1923 he became associated with the Continental Heater Corporation.

Business Changes

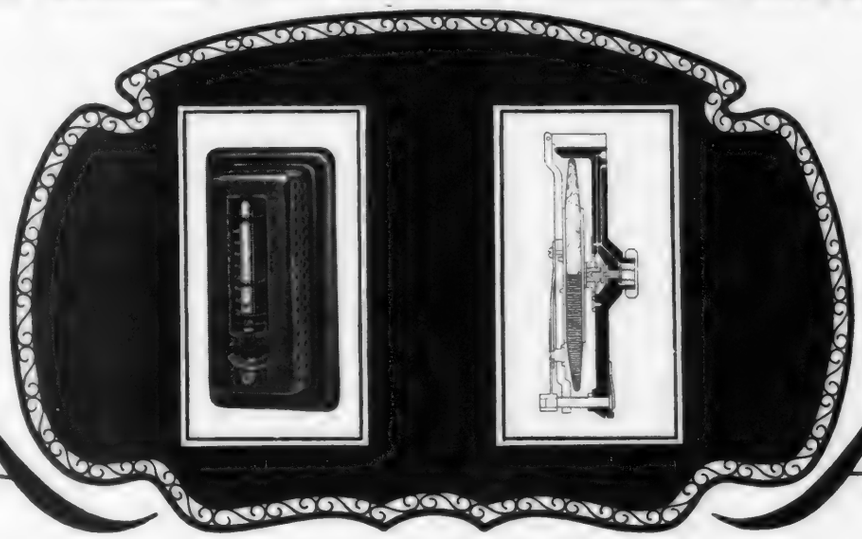
A. Friedman Heating & Ventilating Co., Inc., announces the removal of its offices to larger quarters at 769 Third Ave., New York.

Nelson Plumbing and Heating Co., Detroit, Mich., advise that the company has removed its office and showroom to 3265 Joy Road.

Lewis, Warren & Ronald is the new firm name of Lewis and Warren, 1001 Realty Bldg., Lexington, Ky., which has been occasioned by the election as a member of the firm of Edward R. Ronald, who has been associated with the company for five years.

Harry S. Kaiser, formerly associated with Hanley and Co., announces the organization of the H. S. Kaiser Co., ventilating and sheet metal contracting engineers, with offices and shop at 31 West Kinzie St., Chicago. This is an Illinois corporation with capital stock of $30,000.

CORRECT because CONSTANT because GRADUATED



The Powers Vapor Disc Thermostat
Famous for its accuracy and great durability

The Powers System of Temperature Control is Differentiated from All Others by Several Exclusive Features

ONE important feature of the Powers System is its performance in giving *true* graduated control of valves or dampers, so that—

1. Valves controlling radiators or coils are not wide open at one time and tightly closed at another but take and ***hold*** the intermediate position that feeds the steam or hot water in exact proportion to the heat requirements; or

2. Dampers mixing hot and cold air, take and ***maintain*** the intermediate position that delivers properly warmed air to the rooms without the alternating drafts of hot and cold that are so objectionable in many indirect and forced air heating systems.

When positive control is desirable, we supply it, of course.

Write for our (free) book which fully covers this important subject

THE POWERS REGULATOR CO.

36 years of specialization in temperature control

2718 Greenview Avenue, Chicago

Atlanta	Cincinnati	Houston	Minneapolis	Pittsburgh	San Francisco	Seattle
Baltimore	Cleveland	Indianapolis	Nashville	Portland	CANADIAN OFFICES	
Boston	Denver	Kansas City	New Orleans	Rochester	Toronto	Winnipeg
Buffalo	Des Moines	Los Angeles	New York	St. Louis	Montreal	Calgary
Butte, Mont.	Detroit	Milwaukee	Philadelphia	Salt Lake City	Halifax	Vancouver
Charlotte, N. C.	El Paso					

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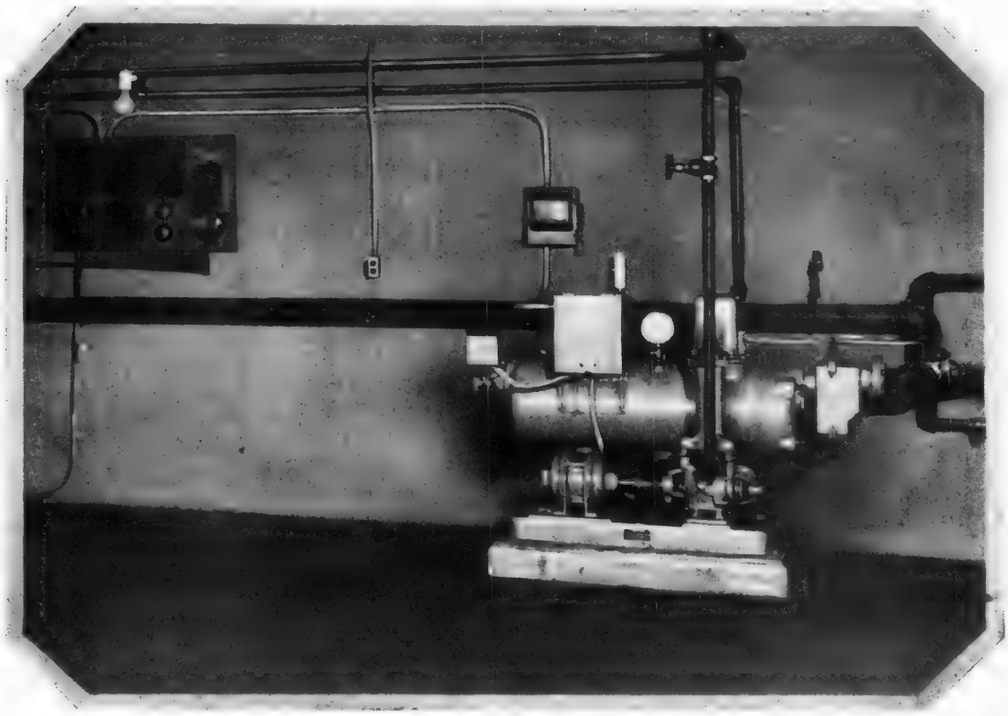


View showing a motor-driven Jennings Heating Pump in the Mack Motor Truck Building, Worcester, Mass. Note the simplicity of the layout, and the compact arrangement.

Easy to install

ALL that is necessary to install the Jennings Vacuum Heating Pump is to connect it to the heating system, and to run the electric power to the motor starter.

Receiver, pump, motor and motor control are mounted as a unit on a single base. Receiver and pump are interconnected by cast manifolds, electric wiring between motor and starter is furnished encased in metal conduit.

The Jennings not only promotes convenience in layout and installation. But also does away with the expense and delay involved where the several parts of an outfit have to be piped and wired.

Bulletin No. 37 is the one to ask for.

NASH ENGINEERING COMPANY

SO. NORWALK **CONNECTICUT**

Branch Sales Offices: Atlanta, Birmingham, Boston, Buffalo, Chattanooga, Chicago, Cleveland, Dallas, Denver, Detroit, Indianapolis, Kansas City, Memphis, Miami, Minneapolis, New Orleans, New York, Omaha, Philadelphia, Pittsburgh, Portland, Richmond, St. Louis, Salt Lake City, San Francisco, Seattle, Tampa, Washington, D. C. **In Canada:** Montreal, Toronto and Vancouver. **European Offices:** London, Eng., Norman Eng. Co.; Brussels, Belgium, and Amsterdam, Holland, Louis Reijners & Co.; Oslo, Norway, and Stockholm, Sweden, Lorentzen & Wettre.

Jennings Pumps

RETURN LINE AND AIR LINE VACUUM PUMPS CONDENSATION AND CIRCULATING PUMPS

Trade and Miscellaneous Notes

Coming Events

April 5-7, 1927. Annual convention of American Oil Burner Association, in Buffalo, N. Y.

April 13-14, 1927. Fourteenth annual convention of the National Warm Air Heating and Ventilating Association, in Cleveland, O. Headquarters at Hotel Cleveland.

May 9-12, 1927. Thirty-first annual meeting of the National Fire Protection Association in Chicago, Ill.

May 17-20, 1927. Eighteenth annual convention of National District Heating Association in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

May 23-26, 1927. Spring meeting of American Society of Mechanical Engineers in White Sulphur Springs, W. Va. Headquarters at The Greenbrier.

June 1-4, 1927. Thirty-eighth annual convention of the Heating and Piping Contractors National Association in West Baden, Ind. Headquarters at the West Baden Springs Hotel.

June 28-30, 1927. Semi-annual meeting of the American Society of Heating and Ventilating Engineers, at White Sulphur Springs, W. Va.

Miscellaneous Notes

Dr. A. A. Adler, consulting engineer, New York, made a radio address over station WMSG, on February 25, and explained to his unseen audience how to select suitable heating equipment for various types of homes.

American Society of Mechanical Engineers has accepted the custody of $17,500, given by the Lincoln Electric Co., of Cleveland, O., to be awarded, under the rules of the competition, to those contributing the best three papers disclosing new information that will tend to advance the art of arc welding. The first prize will be $10,000, the second, $5,000, and the third, $2,500. All papers must be in by January 1, 1928, and the awards will be presented at the stated 1928 Spring meeting of the society.

L. H. Prentice Co., Chicago, Ill., one of the best-known heating contracting concerns in the Middle West, celebrated its fiftieth anniversary, February 1. The event had special significance to the Heating and Piping Contractors National Association inasmuch as Leon H. Prentice, the founder of the company, now retired, was president of the association in 1899, while Harry M. Hart, who is now at the head of the company, also holds the office of president of the association for 1926-1927.

Heating and Piping Contractors New York State Association will hold its annual meeting in Syracuse, N. Y., April 20-21. Among the topics which will have a prominent place on the program are certified heating, standardization, legislation, education and separation of contracts. Edward F. Joy, of Syracuse, is in charge of the arrangements.

"Home Brew" Heating is the characterization given by the American Gas Association, in its publication, "Gas Progress," to the use of all fuels other than gas, on the ground that gas is the only thing that burns, and when crude fuels are used in a furnace, the dweller is making his own gas.

Cities Service Company and its subsidiaries report the sale of 4100 residential gas-fired house-heating installations in its manufactured and natural gas properties in 1926. The estimated gas consumption of these installations during 1926 and 1927 is 750,000,000 cu. ft.

National Trade Extension Bureau announces that A. B. Pierce, vice-president of the N. O. Nelson Mfg. Co., St. Louis, has assumed the duties of treas-

REGISTERED AUTOVENT.

"The Mark of a Well-Built Fan"

Automobiles and Ventilation

READ an automobile ad. Then listen to the salesman as he talks. Back of his car's merits is something far deeper, vastly more stirring than any piece of man-made machinery will ever be.

What is it? It's the **joy** and **health** and **satisfaction** of care-free motoring! That's what sells the car.

So, in selling Autovent Fans

Remember to talk hot-weather comfort, fewer headaches or bigger production. That's what sells the fan! The oftener you picture lasting results from **dependable** Autovent Fans, the faster your business expands.

Have you our catalog and discounts? If not, write.

Estimates and prices cheerfully furnished by our Engineering Department.

AUTOVENT FAN & BLOWER CO.

730-738 W. Monroe St., CHICAGO

ENGINEERS IN ALL PRINCIPAL CITIES

AUTO (Automatic) VENT (Ventilation)

{GUARANTEED}

urer of the bureau, succeeding the late L. C. Houseman, who died last September. Mr. Pierce served as president of the National Pipe and Supply Association from 1921 to 1923.

National Fire Protection Association will hold its thirty-first annual meeting in Chicago, May 9-12, next. Headquarters will be at the Congress Hotel, at Michigan Avenue and Congress Street.

Indianapolis, Ind.—The first Foreman Training Conference for the Plumbing and Heating Industries in America has been organized by the Indianapolis Merchant Plumbers' Association in co-operation with Purdue University at Lafayette, Ind., and the National Trade Extension Bureau. The first of a series of six conferences was held on Monday evening, February, 14, with an attendance of sixty-five heating and plumbing contractors and their foremen. The series of conferences was in charge of Professor G. F. Buxton of Purdue University, foreman trainer for the State of Indiana.

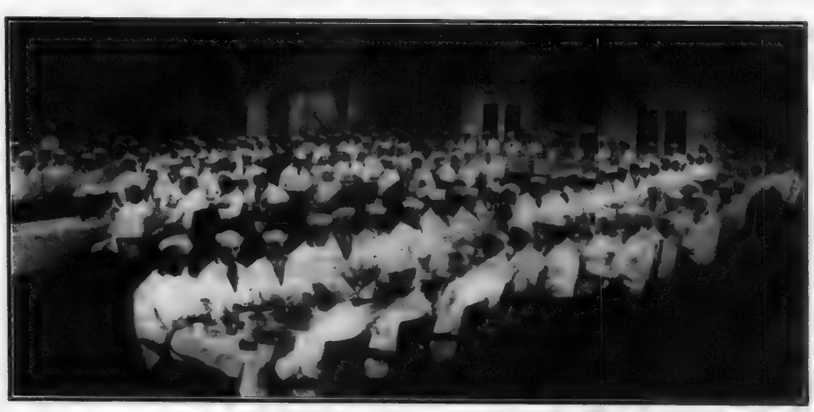
Chicago Heating and Piping Association elected Edgar C. Schulze as secretary of the association, to succeed George H. Dahlquist, who has resigned. Another election at the recent meeting was that of H. F. Neustedt as treasurer. Other officers of the association are: H. B. McGinnis, president, and W. A. Burns, vice-president.

Chicago Association of Consulting Engineers, at the regular meeting in the City Club, January 17, elected the following officers: President, Irving E. Brooke; vice-president, Ernest V. Lippe, and secretary-treasurer, Rollo E. Gilmore, whose address is 104 South Michigan Ave., Chicago.

Sales Organization Dinner on Shipboard

One of the most unique and interesting dinners ever given by a business organization, was that which was held on February 2, aboard the U.S.S. Illinois, by the Preferred Utilities Mfg. Corp., 33 West 60th St., New York. It might be said that this was an oil-burning dinner, for almost every one present was in some way connected with the oil-burning industry. The dinner and entertainment was called "Saler's Follies," and was a play on the words "sails" and "sales."

This company, as a sales organization for equipment used by oil companies and for oil-burning equipment, had a splendid background for this "saler's" idea.



Preferred Utilities Dinner on U.S.S. Illinois

Minneapolis Heat Regulator Company's New Factory

Steadily increasing business has forced the Minneapolis Heat Regulator Co., Minneapolis, Minn., to provide additional space to handle properly the increase of sales. The old building, shown on the right of the picture, contains some 70,000 sq. ft. of floor space and until a short time ago was ample to take care of every demand.

New Factory of Minneapolis Heat Regulator Company

Within a short period of time, however, the business outgrew the old quarters and a new building was found necessary to provide the required facilities. The new six-story structure shown on the left-hand side and in the central portion of the picture is the result.

This new building is being rushed to completion, and by Spring the right wing and tower will be ready for occupancy, adding 70,000 sq. ft. of floor space, of which the general offices will occupy 20,000 sq. ft. In the meantime, night shifts are being used to carry over until the new quarters are ready.

Prospering with Oil-O-Matic

What is probably the most comprehensive and elaborate sales promotion presentation that has yet been issued in the oil burning or heating industry has just been received from the Williams Automatic Heating Corporation, Bloomington, Ill. This might literally be called a portfolio as it is 11-in. by 15 in. in size and consists of 40 pages printed on heavy plate paper. The portfolio is almost entirely photographic and is designed for use by the factory road men in their contacts with prospective dealers.

One double-page display shows in pictures on one page women working with the vacuum cleaner, the electric washing machine, the electric iron and the electric sewing machine. On the opposite page is a temperature chart showing a uniform inside temperature with a widely varying outside temperature. Above the chart is a picture of a family enjoying an evening at home with the caption "Who Wants to Shovel Coal After Dinner?" The display heading over this double page is "Home Owners Pour Out Money for Labor Saving Devices, Oil-O-Matic Eliminates More Work Than All Others Combined."

This is typical of the entire portfolio, which incorporates the principles of the elaborate and very comprehensive retail sales plan that with the Oil-O-Matic salesmanship course is available to every dealer.

This portfolio is naturally not for general use, but it warrants mention as indicating the high state of industrial development that has been reached by at least one important manufacturer in the oil-burner field.

This bellows is the heart of the Sylphon Packless Expansion Joint. It is drawn and formed seamless from specially prepared metal, and is the most flexible, yet durable, expansion unit known.

Packless Expansion Joint

for steam heating risers

OBVIATES the use of "expansion loops" with their waste of valuable story-height space; of packed or "sliding sleeve" expansion joints with their repacking requirement, which is an almost impossible job in the case of a riser concealed in furring. Besides, the packed joint may be loose enough to leak, or tight enough to jam.

Steam Tight, Yet Free to Move Without Jamming

The new Sylphon Packless Expansion Joint, because it contains the well-known, seamless, all-metal Sylphon Bellows, which acts as a continuous yet flexible barrier against the escape of steam, is steam-tight at all times, requires no attention, yet has perfect freedom of motion without risk of jamming.

Easily Installed Right in the Vertical Riser

The cost of assembling a large expansion loop on the job is generally more than the cost of a Sylphon Packless Expansion Joint; and, besides, you can install one of these joints in the lines as simply as any other single pipe fitting, and it is as permanent as any other part of the structure.

If you would avoid damaging strains on pipe work, and tapping of radiator branches, install Sylphon Packless Expansion Joints in all heating risers.

Ask for Bulletin WEJ-100, which gives full data, dimensions, list prices and shipping weights.

THE FULTON COMPANY KNOXVILLE, TENN.

ORIGINATORS AND PATENTEES OF THE SYLPHON BELLOWS

SALES OFFICES IN: New York Chicago Detroit Boston Philadelphia
and all the Principal Cities in U. S.

European representatives: Crosby Valve & Engineering Co., Ltd.
41-42 Foley Street, London, W. 1, England

Canadian representatives: Darling Bros., Ltd.
120 Prince Street, Montreal, Canada

Manufacturers' Notes

Stickle Steam Specialties Co., Indianapolis, Ind., announces the appointment of E. T. King as sales engineer to take charge of the middle west territory. Mr. King was formerly engineer in charge of the heating division of the Merchants Heat and Light Company.

Armstrong Machine Works, Three Rivers, Mich., held a get-together meeting and banquet of its officials and forty-five factory representatives, in Chicago, February 15. A. E. Armstrong, president of the company, delivered the principal address, recounting the long history of the development and perfection of the Armstrong trap, and outlined the company's plans for the future.

Kellogg-Mackay Co., 2020-30 Walnut St., Kansas City, Mo., announces the opening of its new building and salesrooms, on March 9, at which time a luncheon was given.

Botfield Refractories Co., Philadelphia, Pa., has appointed Frank J. Donnelly on the staff of the New York office to take charge of the New Jersey territory under the direction of Charles C. Phillips, New York district manager.

Blower Systems Corp., 362 Plymouth Ave. South, Rochester, N. Y. announces the appointment of George G. Dobson, formerly with the engineering department of the Eastman Kodak Company, to specialize on industrial problems involving the conditioning and handling of air.

Autovent Fan & Blower Co., Chicago, Ill., announces that its representative, C. E. Kallister, Peoria Life Bldg., Peoria, Ill., has associated with him Harry D. Lefler who will cooperate with contractors, dealers and jobbers in order to assist them in developing a greater volume of ventilating fan business.

Dunham Co., Berea., O., has appointed C. A. ("Jack") Thorne, 66 N. Brookville Ave., Indianapolis, to represent the Bull's Eye water heater in Indiana, south of Lafayette and Anderson, also in Louisville and Lexington, Ky., and Cincinnati, Dayton and Greenville, O.

International Heater Co., Utica, N. Y., has opened an office at 27 State St., Boston, Mass., with D. W. Boynton and J. W. Briggs in charge.

Buckeye Blower Co., Columbus, O., announces the opening of a branch office on March 1, at 409 Loan & Trust Bldg., Milwaukee, Wis. Jerome J. Kelly, formerly with Bayley Mfg. Co., has been appointed district manager.

Hoffman Specialty Co., Waterbury, Conn., announces the appointment of F. H. Gaylord, formerly manager of the Chicago branch, as director of sales in Zone C, which comprises the eastern central states. N. Paul Fenner has been appointed district office manager of the Chicago branch. Headquarters for Mr. Gaylord and Mr. Fenner will continue to be the company's Chicago office, at 130 North Wells Street.

Kieley & Mueller, Inc., 34 West 13th St., New York, are now represented in the Pittsburgh territory by R. S. Eastman Co., sales engineers, 218 First Ave., Pittsburgh, Pa. Another appointment is that of the Engineering Sales Co., Milwaukee, Wis., as representatives in Wisconsin and Northern Michigan.

Trane Co., LaCrosse, Wis., has opened an eastern executive branch office and warehouse at 600 South Delaware Ave., Philadelphia. This office will be in charge of William F. Bilyeu, and the warehouse containing all types of standard Trane equipment, will be a part of the new service from Philadelphia. Beginning April 15, the Philadelphia district sales office will be located at the same address, and Robert M. Lapsley and Ben Bowen will operate as sales engineers in the local territory.

Chicago Pump Co., Chicago, has appointed Tandy L. Jackson as district manager of the Cleveland office, which is located in the Plymouth Bldg., 2036 East 22nd Street.

Southwestern Engineering Corp., 1221 Hollingsworth Bldg., Los Angeles, Calif., has appointed Bernard E. Tiltz as manager of the air conditioning department. Mr. Tiltz has discontinued the operation of his former business, the Tiltz Engineering Company.

PECCO

UNIT HEATERS

for

Increased Heating Efficiency

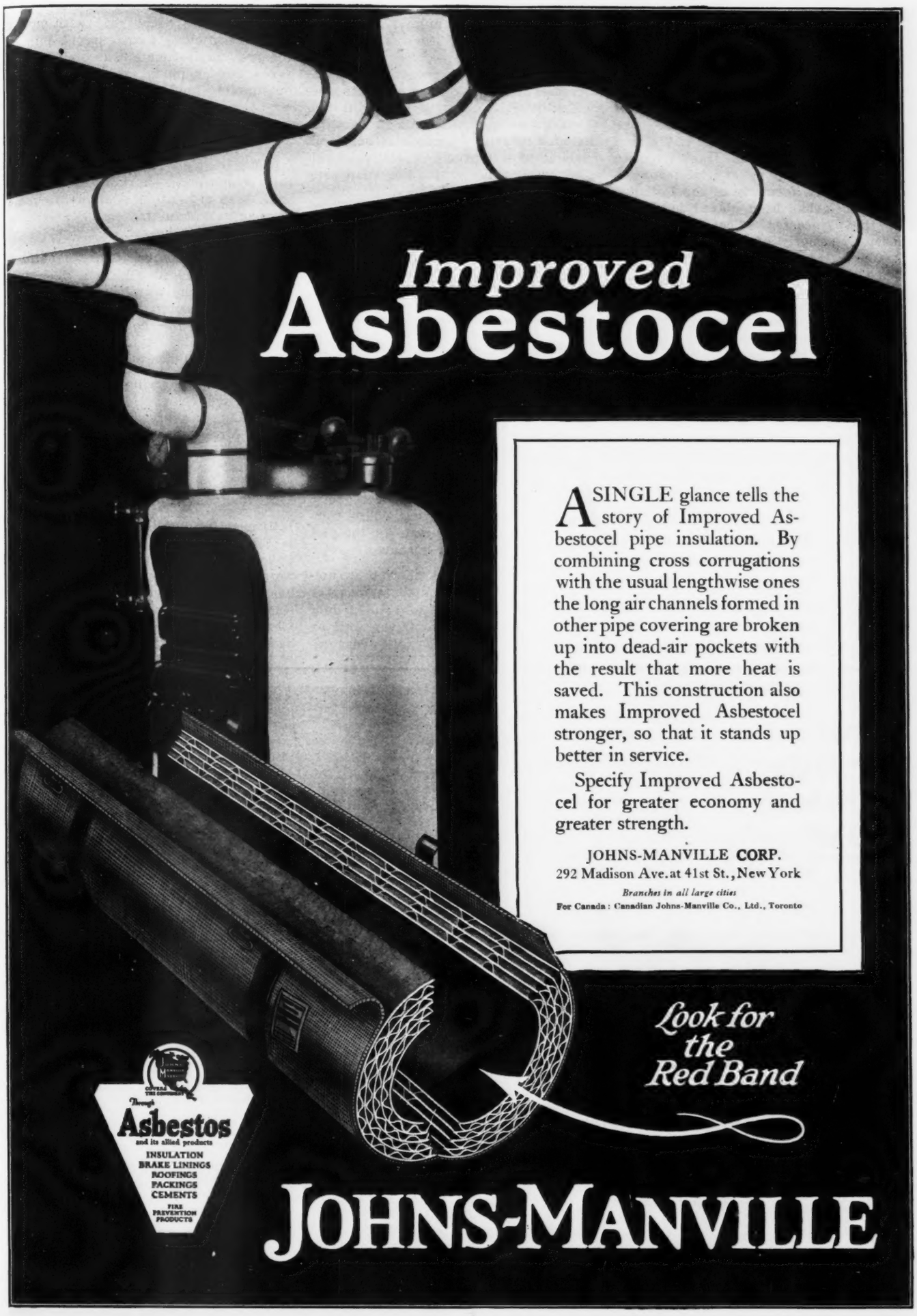
The design of Pecco Unit Heaters follows fundamental engineering principles and positively insures the most complete and thorough **re-circulation** of **all** air in the building. It results in high operating efficiency, principally because air circulation is **not** confined to an area immediately under the building roof.

In addition to floor type unit heaters, Pecco, Inc. also builds the so-called "copper fin" ceiling-suspension heater, which is recommended only where it is desirable to warm merely the air at and near the ceiling and where efficient over-all **re-circulation** is not essential.

This external view shows some Pecco Unit Heater features. Note that the cold air intake fan is located where it belongs —near the floor at the cold air level.

"Heat With Unit Heaters"

PECCO, INCORPORATED, 2980 North Market Street, St. Louis, Mo.



Improved Asbestocel

A SINGLE glance tells the story of Improved Asbestocel pipe insulation. By combining cross corrugations with the usual lengthwise ones the long air channels formed in other pipe covering are broken up into dead-air pockets with the result that more heat is saved. This construction also makes Improved Asbestocel stronger, so that it stands up better in service.

Specify Improved Asbestocel for greater economy and greater strength.

JOHNS-MANVILLE CORP.
292 Madison Ave. at 41st St., New York
Branches in all large cities
For Canada: Canadian Johns-Manville Co., Ltd., Toronto

Look for the Red Band

Through Asbestos and its allied products
INSULATION
BRAKE LININGS
ROOFINGS
PACKINGS
CEMENTS
FIRE PREVENTION PRODUCTS

JOHNS-MANVILLE

Lincoln Electric Co., Cleveland, O., announces the following changes in its sales personnel: G. N. Bull, formerly with the Worthington Pump & Machinery Company, in the Washington, D. C., office, has been appointed district manager of the New York office. C. S. Freeman, formerly in charge of the Lancaster office, has been transferred to the Buffalo office as district manager. S. W. Shultz, formerly of the Philadelphia office, has been placed in charge of the Lancaster office. Edward J. Pfister, formerly of the Buffalo office, has been transferred to the Philadelphia office.

United States Radiator Corp., Detroit, Mich., at the annual meeting of stockholders, held February 23, in Buffalo, elected the following directors: Henry T. Cole, George A. Ducharme, Robert J. Gross, E. E. McNair, S. T. Miller, Fred T. Murphy, M. J. Murphy, J. Brooks Nichols, and L. H. Paddock. At a meeting of the board of directors, held March 5, in Detroit, the following officers were elected: President, Henry T. Cole; vice-presidents, E. E. McNair and J. F. McIntire, and secretary and treasurer, W. E. Mosher. At this meeting of the board, the directors declared the regular quarterly dividend of fifty cents a share on the common, and one dollar and seventy-five cents a share on the preferred capital stock, both payable on April 15, to stockholders of record at the close of business April 1.

The seventeenth annual report to stockholders, shows the result of the operations of the corporation during the past fiscal year, and reflects a moderate increase in net earnings over the preceding year. Owing to advanced features in selling policies a substantial increase in sales volume was obtained, but, due to increased competitive conditions, lower sales values prevailed with narrower profit margins—a condition which still is confronted in common with the existing tendency in other industries.

As evidence of progress, this corporation reports that its serial bond issue has been retired in full, together with a payment of $190,000 to the Federal Government, in full settlement of all excess income tax assessments for the fiscal years ending January 31, 1918, to January 31, 1923, inclusive. In addition to these disbursements, the dividend distribution on the "no par" stock has been increased by a recent extra dividend of sixty cents per share, and an increase in the quarterly rate to fifty cents per share, an annual rate of $2 per share based on earnings of $5.85 per share for the past year. This compares with an earning rate for the preceding year of $5.49 per share.

Balance sheet figures show that, notwithstanding the final disbursement of $290,000 for retirement of bonded debt and extra tax assessments, as well as the increased dividends, the corporation closed its fiscal year with no indebtedness other than current bills, a reserve for estimated annual income taxes, and an unmatured balance of an outstanding land contract.

Franklin Gas Burner Appliance Co., Cincinnati, O., announces its removal to 221 East 8th St., where a large electric flasher sign will be erected to feature Franklin gas-burners and Honeywell heat regulation equipment. This company also manufactures the Gascola, a coal and gas heater.

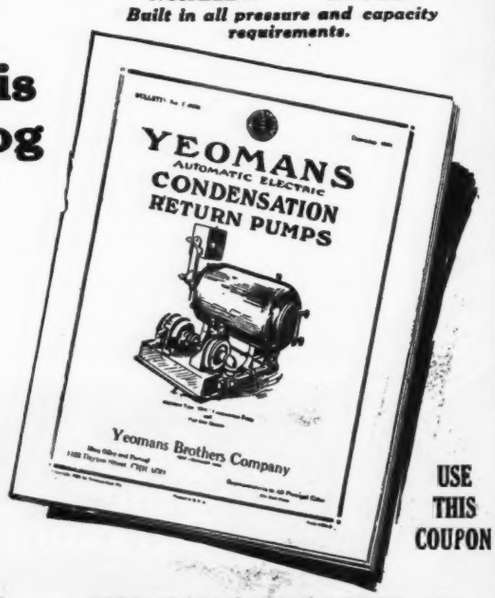
National Radiator Co., Johnstown, Pa., has moved its Chicago office into a new office and warehouse building at 2445 North Keeler Ave., where a complete line of the company's products will be carried. David H. Cuyler is in charge of the office and warehouse.

Sterling Engineering Co., Milwaukee, Wis., announces the election of George W. Anders as president of the company. Mr. Anders, who has been secretary of the company for several years, succeeds C. J. Rice, who resigned to become sales manager for the Modine Mfg. Company, of Racine, Wis.

Excelso Products Corp., Buffalo, N. Y., is the name under which the Excelso Specialty Works will operate hereafter. As announced last month, the company has been taken over by the American Radiator Company and C. W. Farrar, vice-president of the former company, has been elected president.

Send for this Catalog NOW

NOISELESS RUGGED
Built in all pressure and capacity requirements.



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Types
Plans
Sizes
Dimensions
Capacities
Specifications

USE THIS COUPON

YEOMANS BROTHERS CO.
Representatives in principal cities
1421 Dayton St., Chicago, Ill.

Please send catalog:

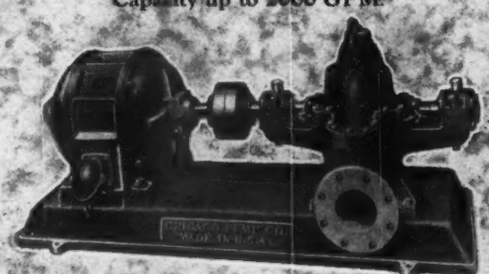
Name .....

Address .....

City .....*State*.....

4

for **Refrigeration**
use Good "CHICAGO" Pumps
Type "D"
Single Stage Horizontally Split
Sizes 1½" to 6"
Capacity up to 2000 GPM



Ball Bearings—Balanced Impeller
Accurate Alignment—Filtered Oil

CHICAGO PUMP COMPANY
SEWAGE-CONDENSATION-CIRCULATING
BILGE-FIRE-HOUSE-VACUUM
2325 WOLFRAM ST. · · CHICAGO, ILL.

For March—a highly effective campaign for proper garage ventilation

Liberty
Liberty
March 26, 1927
Bad Air is Bad Business
INVISIBLE ODORLESS DEADLY GAS that strikes without warning!
It all happened yesterday. One mechanic lost a bolt or two. He didn't think it would be noticed. Another forgot to replace a cotter pin. A tester O. K.'d a defective job with a careless inspection. Thus three jobs went wrong. Three cars were brought back for "make good" service—or three customers went elsewhere the next time.
Gas did it—the same deadly, exhaust gas that brings death to car owners in their own garages. In your larger garage—where it cannot concentrate and kill—it is damaging if not deadly. It is damaging to the health of your employees—causing headaches, dizziness, and even dangerous disorders such as anaemia and respiratory diseases. Naturally it results in carelessness, discourtesy and slip-shod work, and you reap the results—financially.
Look the facts squarely in the face and you will understand why American Blower Electric Ventilation is being installed in so many well managed garages. Costing no more than good light; occupying no more floor space; installed without disturbing your business—it is a certain remedy for Gas with its costly attendant evils.
Your electrical contractor should be able to tell you about it. If he can't, mail the coupon below. The American Blower Company—an organization that for 46 years has occupied a position of leadership in the field of industrial ventilation—will give you—without obligation—complete and authentic facts and figures.
AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONT.
American Blower
VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881
GOOD VENTILATION IS ONLY GOOD BUSINESS
Frequency of Air Changes Necessary for Various Applications*
Offices
Tailors
Bakeries
Cabins
Tunnels
Painting Booths
Laboratories
Cowsheds
Ship Holds
Kitchens (Home)
Laundries
Theatres
Assembly Halls
Garages
Dining Rooms
Machine Shops
Lodge Rooms
Foundries
Retail Stores
5 to 10 minutes
3 to 5 minutes
3 minutes
2 minutes
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5 to 10 minutes
5 to 10 minutes
5 minutes
5 to 15 minutes
15 minutes
10 minutes
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5 to 15 minutes
*This table based on climatic conditions in Central United States. Other tables for specific localities are available.
COUPON
AMERICAN BLOWER CO., DETROIT, MICH.
Send details relative to the application of American Blower Electric Ventilation to
(Business)
Name
Address
City and State
13
621
UTHERLAND
NHEIM

Specify American Blower Ventilating Equipment for Garages!

B. F. Sturtevant Co., Hyde Park, Mass., announces the removal of its New York office to the Graybar Building.

Handon Boiler Corporation, Poughkeepsie, N. Y., has taken over the business of the Hudson River Foundry Co., for which the corporation has heretofore acted as sales agent, and has increased its capitalization to $1,000,000 preferred and 30,000 shares of common stock to provide for extensions to the plant just acquired. The management of the Handon Boiler Corporation remains the same as heretofore.

General Boilers Company, Waukegan, Ill., has changed its name to Pacific Steel Boiler Corporation to be like that of its eastern affiliated corporation of the same name, with a plant at Bristol, Pa.

Preferred Utilities Mfg. Corp., 33 West 60th St., New York, has been formed by engineers, who, in their many years of experience in the oil-burning field, have seen the practical need for certain accessories and, as a result of this experience, have developed ways and means for their production for efficient service. The corporation is now manufacturing the Preferred 100% automatic damper, swivel vent protector, flush box and water-tight fill box. Other accessories are now under test in the company laboratory and also in the field. When these tests are satisfactorily completed, announcement will be made of the additional devices.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

PLUMBER AND STEAM FITTER WANTED—First class man capable of installing large jobs. Steady job. Union rate of pay is $12.00 for eight hours. Address Box 41, care of Heating and Ventilating Magazine.

FOR SALE—Two Chicago air line pumps, 10,000 square feet capacity, complete with A. C. motors, tanks, regulators, gauges. The Ohio Edison Company, Springfield, Ohio.

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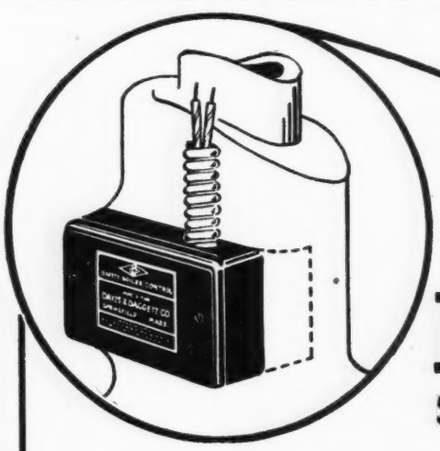

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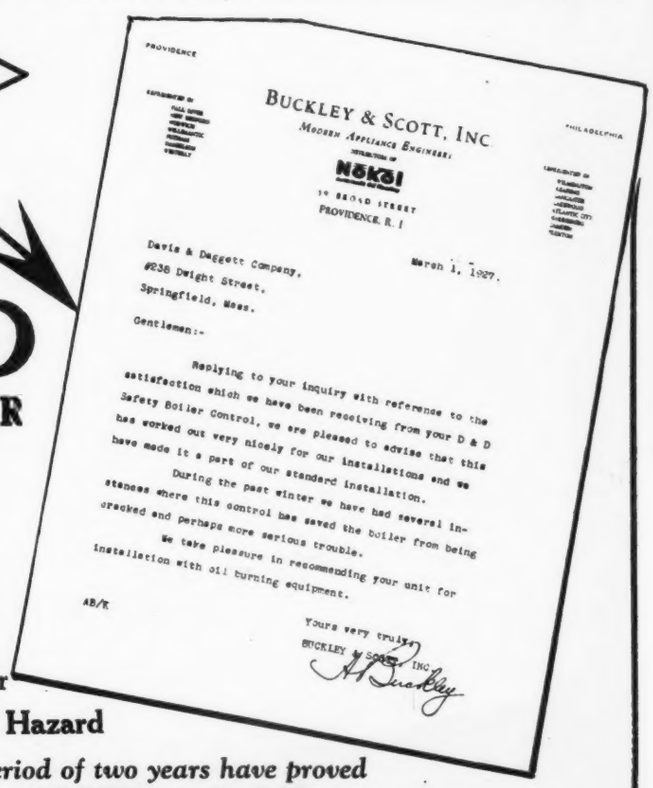

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